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School based nutrition interventions have been shown to improve nutrition behaviors among elementary school-aged children; however, limited research has been done in low- income, ethnically diverse schools. Utilizing constructs from the Social Cognitive Theory (outcome expectancies/ expectations, self-efficacy, sociocultural factors), a randomized school trial was designed to pilot test methods for teaching third through fifth graders to utilize MyPyramid to increase: nutrition knowledge; fruit and vegetable, low-fat dairy and whole grain consumption; physical activity; and positive attitudes about nutrition and physical activity. Participating schools were low-income with high percentages of Latino and African American students. Students ranged in age from 9-11 years. Preliminary data collected from two schools (N= 27 students) guided the intervention development. Elementary schools (N=5) were randomized into intervention and control schools and administered pre- and post-tests. Students (N=49) in intervention classrooms received six 1-hour classes on MyPyramid conducted by a nutrition professional. Lessons were adapted for cultural differences and socioeconomic status using the teacher curricula provided by the MyPyramid website. Controls (N=39) received MyPyramid written materials only. Nutrition knowledge score for intervention students significantly increased from 5.474 to 8.018 as did controls from 7.353 to 8.772. Correct responses for daily recommended dairy servings increased from 45% to 65% in intervention students. No significant changes in behavior were observed. Challenges included lack of parental consent forms, and classrooms with varying levels of language

and reading comprehension, and behavioral problems. Adapted MyPyramid in-class lessons appear to have a positive impact on nutrition knowledge among low-income, diverse elementary school students; however, more research is needed.

STEP UP MYPYRAMID – COMPARING TEACHING METHODS FOR LIMITED RESOURCE ELEMENTARY SCHOOL CHILDREN: A PILOT STUDY

by

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APPROVAL PAGE

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CHAPTER I

INTRODUCTION

The National Health and Nutrition Examination Survey (NHANES) indicates that approximately 17% of children of low socioeconomic status between the ages of 6 and 11 years of age are overweight (1). Low income children who are at risk for or are overweight almost doubled from the 1970s to 2002, with the largest increase seen among adolescent boys (2). In addition to gender differences, the gap between ethnic groups also is growing wider, especially among adolescent girls. Low socioeconomic status has been shown to be a risk factor for overweight; however, this trend is weakening as more variables are being identified to help better understand this increase in childhood obesity (2). For instance, some of the ethnic disparities that exist are due to environment, social culture, education level of parents, and family income (2). In response to these disparities, some national organizations already have been established to address this issue.

The American Heart Association partnered to form The Alliance for a Healthier Generation in order to work against the spread of childhood obesity and associated diseases, including heart disease; it aims to stop the increase by the year 2010. The Healthy Schools Program was launched in 2006 as a part of the alliance (3). Schools became the focus because 30 hours a week are spent sitting in the classroom by one in every five Americans. The Healthy Schools Program also chose to target schools because most physical education program budgets have been reduced over the last several years, along with the increasing percent of obese children. The three main objectives of this program focus on nutrition, physical activity, and staff wellness (3). Teaching elementary students about MyPyramid addresses one of these goals—increasing student knowledge and choices of healthy foods especially in the cafeteria and in the home. Use of these concepts can extend healthy lifestyle behaviors into adulthood.

As overweight continues to rise, especially in children, new strategies to reach children about the importance of a healthy body are needed. In 2005, the MyPyramid.gov website was created to provide personal healthy options geared towards children and adults with a focus on prevention instead of treatment of an unhealthy lifestyle and its effects (4).

Few studies have been completed on the effectiveness of teaching the concepts from MyPyramid in elementary schools. Thus, the *research aim* of this project is for fourth grade students in low income schools to improve diet and physical activity behaviors as a result of information presented on Mypyramid.gov.

The main research question for this project is:

Will in-class instruction of the MyPyramid result in greater improvements in diet and physical activity behaviors of third through fifth graders than provision of written materials only?

Hypothesis

Compared to written materials only, in-class instruction will result in greater improvements in diet and physical activity, knowledge, attitudes and behaviors among 3rd -5th grade students.

Specific Objectives

Third through fifth grade students receiving in class instruction will:

- Increase knowledge of MyPyramid
- Increase fruit and vegetable consumption
- Increase low fat dairy consumption
- Increase whole grain consumption
- Increase physical activity
- Report more positive attitudes about nutrition and physical activity

CHAPTER II

REVIEW OF LITERATURE

The prevalence of overweight children in the United States is 31% in Latino children, 23% in African American children, and 15% in Caucasian and Asian children. Latino children have the highest percentage of being overweight and that rate continues to increase as a large number of the children are at risk. Latino children also have high rates of illness and face barriers to quality medical care (5). Among numerous health risks associated with overweight, type 2 diabetes is a large and growing problem among Mexican-American children (6). Risks for diabetes include both modifiable and non-modifiable risks. Modifiable risk factors include overweight, low physical activity, high fat intake, and low fiber intake (6). Increasing knowledge about the effects of being overweight and its associated diseases can help to encourage Latino children to modify their behavior and reduce these modifiable risks for such diseases as type 2 diabetes. Nutrition educators can play an essential role by increasing children's knowledge and giving them the skills to be more physically active, and consume lower fat and higher fiber diets.

Childhood Obesity

Obesity in childhood is associated with cardiovascular disease risk factors, such as metabolic syndrome, type 2 diabetes, hypertension, and dyslipidemia. Childhood obesity also leads to an increased risk of cardiovascular disease (CVD) in adulthood (7). In addition to CVD, approximately 24% of adults have insulin resistance (metabolic) syndrome. Four to 10 percent of children are diagnosed with metabolic syndrome, a syndrome which is correlated with coronary heart disease, stroke, type 2 diabetes, and mortality (8). One of several symptoms of metabolic syndrome is obesity. A body mass index (BMI) of $\geq 30 kg/m^2$ is an indicator of obesity. One and two-year predictors of excessive weight gain among 9 to 12 year olds include a high baseline BMI ($\geq 90^{th}$

percentile), no sports outside of school, playing video games daily, and little activity (9). Treatment options for the rising epidemic of childhood obesity include dietary intervention, increased physical activity, pharmacotherapy, or surgery (7). Gray et al. concluded that the greatest impact for a large population of children would result from changes in diet and activity level. Physical activity has been overtaken by the prevalence of sedentary activities in which many children participate after arriving home from school. Watching TV, sitting in front of the computer, and playing video games are major reasons physical activity no longer accounts for a significant amount of a child's daily routine (10).

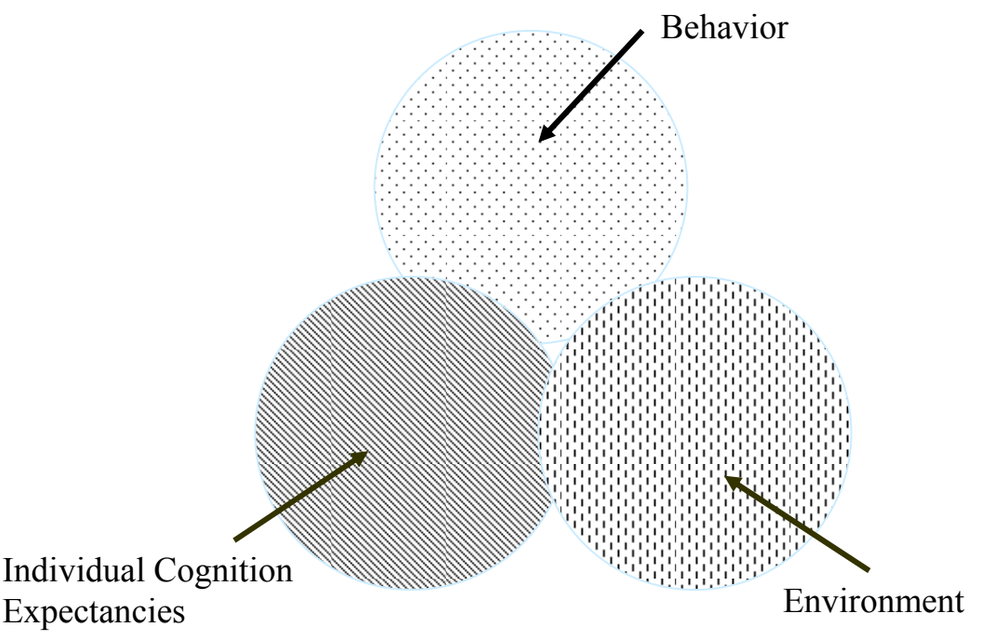
In addition to an abundance of sedentary activity, family income has been found to be a strong predictor of children's weight status. Children in families of low income face socioeconomic barriers to physical activity, such as unsafe neighborhoods or playgrounds. Healthy foods are not always affordable (10). There are significantly fewer food stores in low-income areas compared to higher income areas, therefore limiting options for healthy shopping and possibly causing a transportation limitation. Low family income and ethnic disparities are correlated with a high incidence of at risk or overweight children (10). Overcoming limitations and providing families with health information and knowledge can help to reduce the rising epidemic of overweight children. To best reach children at risk, interventions should take place in schools, particularly low-income schools, in the community, and through programs set up to help low-income and various ethnic families. Several studies and programs have been and continue to be implemented, particularly geared toward children and in school settings (11, 12).

Social Cognitive Theory

Social Cognitive Theory (Figure 1) is Bandura's behavioral theory that proposes that several factors can have an influence on each other—if one changes, the others will change. Reciprocal determinism is a continuous interaction of the environment and the person and his/her behavioral capability. The person is in control of his/her life. The environment and factors affecting it are external to the person. There are three types of environment—social (people), physical (foods), and

the situation (perception of environment). Behavioral capability is the preparation the person must first receive to understand the behavior and how to execute the behavior before actual performance. A program based on reciprocal determinism is focused on the individual and environment in addition to behavior. Goals, self-efficacy, outcome expectations, and sociocultural factors/facilitators can all interact and lead to a change in behavior (13). With this theory of behavior change, any change in behavior, individual cognition expectancies, or the environment will influence and affect each other.

Figure 1: Social Cognitive Theory



History of the National School Lunch Program

Schools can help ensure appropriate dietary intake in children. The National School Lunch Program was established in 1946. Program guidelines state that the food provided at schools should include at least 1/3 of dietary reference intakes (DRIs). Meals are provided at reduced prices or free to families that cannot afford them. Nutrition education also is a component of the program (14). In order to assess school adherence, the Centers for Disease Control and Prevention (CDCP)

conducted the School Health Policies and Programs Study. The study was conducted in all 50 states and included both questionnaires and interviews. A nationally representative sample of private and public elementary, middle, and high schools was used in the information collection. The researchers found few schools restricted the availability of fried food or low nutrient dense foods. Healthy beverages were not as readily available either. Outside of the school nutrition programs, healthy foods and beverages were offered, but so were foods of high fat, sodium, and sugar content. The study found that school menus need improvement. Improvement of the health of children through the school system can be accomplished through healthier food preparation and opportunities to encourage healthy eating, such as serving more fruits and vegetables, whole grains, and low-fat dairy (15).

One of the choices of children's diets that needs to be addressed is choice of beverages for consumption. Children at school have choices either in the cafeteria line or at the drink machine. The American Obesity Association reports the USDA stated that 16% fewer children drink milk today than in the late 1970s and 16% drink more soft drinks (16). Beverage consumption and many other aspects of children's environments have likely contributed to the increase in child obesity. The USDA has made and continues to make recommendations and strategies to encourage healthy eating and physical activity. In order to best reach children, one of the most effective methods is by teaching nutrition and the USDA recommendations within the school system (16).

Interventions for Elementary School aged Children

In classroom

Intervention in the classroom is important to be able to convey nutrition knowledge to students and to give them the tools to make healthy decisions. Third and fourth grade is a level at which children can comprehend the nutrition information given to them and make informed decisions about the foods and beverages they are consuming (18, 20). They are still young so attitudes and behaviors can be influenced. As noted below, many studies successfully implemented

nutrition education programs targeting this age group (11, 12, 17, 18). In order to be able to change behavior, both the environment and personal characteristics must be addressed (11, 12, 13).

Several studies have been conducted in elementary schools. These studies have been focused on improving the overall health of children. Many schools have self-supporting nutrition programs through reimbursement from the USDA and parent tuition. In North Carolina, funds for each school from these sources can vary by year; therefore, a la carte sales in the lunchroom bring in a large portion of revenue for the school. Additionally, vending machines also provide a large source of food for children in schools (17). Thus, many school based interventions focus on food and drink offerings from a la carte menus and vending machines.

An example of these efforts is seen in Eat Smart, North Carolina's recommended standards for all foods available in school. The program has set up North Carolina (NC) Healthy Schools with the purpose of creating a means of communication between educators and health professionals. NC Healthy Schools centers on eight components: school health education, health services, safe physical environment, counseling and social services, physical education, nutrition services, health promotion for staff, and family and community involvement within the school. This program is voluntary for schools, but it offers many tools and support for its integration (17, 19). School administration, teachers, and parents must all work together in order to impact each school (17). Examples of some tools provided through the website include flu resources, elementary health education lessons, energizers (physical activities), diabetes support, and crisis planning (19). Although not a part of NC Healthy Schools, one example of a health education curriculum entitle the Great Grow Along reaches older elementary students through a different approach.

The Great Grow Along Curriculum is a six week curriculum for fourth to sixth graders. Schools were recruited from metropolitan and rural areas of South Dakota, North Dakota, and Minnesota. The curriculum includes the use of videotapes, experimental procedures, and other activities in order to teach nutrition. An animal care and feeding project taught students nutrition and the scientific method. Teachers volunteered to participate and pre-and post-tests were used to

assess the amount of knowledge the students gained regarding nutrition and scientific method knowledge, along with assessing nutrition attitudes. Students (N=1172) were receptive and interested in the program and showed an increase in nutrition knowledge for all the grades observed (18). Pre and post-tests were effective in determining if the nutritional instruction was absorbed and retained. The teachers were given a kit and allowed to adjust the program to their style, wants, and feasibility in the classroom. Kits included activities, a poster of the Food Guide Pyramid (old version of MyPyramid), and nutrient cards on specific foods (18). Throughout implementation of the program, both teachers and students learned about nutrition.

Teaching nutrition through a different approach, Robertson et al. reviewed a study entitled Nutrition Pathfinders (20). This study was a program set up by the Dairy Council of California for third through fifth graders. The goal was to reinforce the food pyramid by healthful food and physical activity, therefore minimizing the risk for becoming overweight or obese. A CD-ROM, a workbook, and the web were used as tools for sources and support for all students, parents, and teachers. Students in the intervention group (N=445) had a 3-day camp experience and experienced daily food choices and physical activity situations. They were taught to increase play activity, increase knowledge about the Food Guide Pyramid, and how to differentiate between healthful and unhealthful foods. Controls, or the comparison group, were comprised of 76 children. Students who completed the program (N=521) showed 54% improvement in knowledge of the Food Guide Pyramid and healthful eating, while the control group showed a 41% improvement ($p<.05$), a significant difference between the two. Change in intentions relating to nutrition of the students was recorded (20). This age group, 3rd to 5th graders, is receptive and still at an early age so that behaviors and attitudes may be influenced. The comprehension and maturity level of the students also allowed use of multiple teaching tools. Using worksheets can be a very helpful hands-on learning tool for use inside the classroom, while the WEB can be very advantageous also (20). Also focusing on 3rd graders, the following study aimed to change attitudes and behaviors using the Social Cognitive Theory (SCT) as the theoretical basis.

Powers et al. examined a nutrition based education program that was designed based on SCT (11). A convenience sample of second and third graders (N=1100) from public schools in Alabama were studied. At least 51% of these children were receiving free or reduced-price meals. Six weekly classes were given based on materials from Dairy Council, Wellness Inc., and the American Heart Association. Researchers used both a pre- and post-assessment of dietary behavior and nutrition knowledge. Concepts enforced were hands-on through nutrition messages on bulletin boards. Pizza Please, an interactive game, and a questionnaire tested children's knowledge. The study focused on Social Cognitive Theory's importance of the relationship between the environment, behaviors, and personal characteristics. Researchers taught skills to choose healthy foods, used the educators as role models in the lunchroom, and reinforced concepts through bulletin board messages. The treatment group showed a significant ($p<.001$) improvement both in dairy consumption and fruit and vegetable consumption. Overall nutrition knowledge increased significantly regarding categories of food guide pyramid groups, nutrient-food association, and nutrient-job association (11). These positive influences have promise for being the basis of further nutrition decisions in life. This is one of few programs completed that focuses on children with free or reduced-price meals in schools.

A representative survey conducted in New York City used both household questionnaires and 24-hour recalls to learn of the diet habits of 2nd (N=693) and 5th (N=704) graders. Diets were scored according to the Food Guide Pyramid and 5 A Day. Students were representative of diverse socioeconomic backgrounds from both private and public schools. Parental consent forms were distributed and collected before the study was completed, with about a 50% return rate (21). Diet records showed that all ages of children under-consumed recommended servings of vegetables, fruit, and grains. However, they met the milk and meat recommendations. The authors found that food habits were influenced by school lunch participation, meal skipping, meal preparation by the child, and sociodemographic characteristics. A higher consumption of oils and sweets was found when

children prepared their own meals. These findings indicate that education and intervention are needed in order to reach recommendations for a healthy diet, particularly to meet 5-a-day (21).

With the aim of altering the environment of low socioeconomic status children, another study incorporated the 5-a-day campaign into a nutrition program in the classroom. Domel et al. conducted the study in two similar schools in Richmond County, Georgia (12). Over a six week period of 18 sessions, all 4th and 5th graders at one control school (N=6 classrooms, 106 students) and one intervention (N=10 classrooms, 195 students) school participated which were randomly assigned. The schools consisted of students in the lower to middle socioeconomic status, with over 50% being African American, and the other portion mainly consisting of white students. Within the SCT, the construct of reciprocal determinism was the basis for the curriculum. Reciprocal determinism is the idea that the environment, behavior, and the individual all influence each other. More specifically, if there is a change in the environment, behavior and the individual will be changed also. "Gimme 5" was created in order to influence the environment and skills of the children to promote increased fruit and vegetable consumption. Lessons were three times a week, focusing on one color of fruits and vegetables a week. Strategies for influencing the environment included providing food recipes, and introducing goal setting, self-monitoring, and problem solving. Researchers used self-reported pre- and post-diaries to determine student change. Researchers found the experimental school increased servings of fruit by 50% per day ($p<.001$), but there was no change in vegetable intake as this had been high at the beginning of the study. The control school had a slight non-significant increase (17%) in vegetable intake only (12). Changes in intakes showed the importance of school lunches regarding fruit and vegetable consumption. The SCT served as a good basis for the study and slight changes were seen in diet-related behavior. Messages such as "Gimme 5" that are taught to students are a part of the USDA recommendations for fruit and vegetable intake. These recommendations have changed over time and continue to evolve in order to reach children and adults most effectively.

MyPyramid Development

The USDA made the first dietary recommendations in 1894 (22). Food was divided into five groups: milk and meat, cereals, vegetables and fruits, fats and fatty food, and sugar. In 1941, a National Nutrition Conference took place and the USDA set a recommended daily allowance (RDA) for Americans. During the 1970s, the categories of food shifted to milk, meats, fruits and vegetables, grains, and fats/sweets/alcohol (22). A graphic was created in 1988 to convey variety, proportionality, and moderation. With these as the focus, the Food Guide Pyramid was released in 1992 recommending a healthy diet to Americans through recommended servings of each food group category. The Nutrition Labeling and Education Act set into place a nutrition food label format in 1994. Eleven years later, in response to critique from numerous nutrition organizations, the MyPyramid 2005 website was designed. The focus changed from general recommendations to personal healthy options. Changes to the pyramid included color coded food groups and an emphasis on regular physical activity, as well as incorporating an interactive website (22). The challenge now is to develop innovative ways for disseminating the new MyPyramid to the general public, specifically among children.

Prior to the publication of MyPyramid, the Team Nutrition Pilot Study was conducted by the USDA's Team Nutrition in order to determine the effectiveness and practicality of implementing a comprehensive school-based intervention regarding similar concepts presented in MyPyramid—decrease consumption of fat, increase fruit and vegetable consumption, and increase consumption of a variety of grains. This pilot project was conducted with students in Kindergarten through fourth grade (23). Nineteen schools chosen out of 7 districts participated in the study, with schools representing diverse sizes, socioeconomic statuses, and varying ethnicities. Through classroom lessons, activities, and various nutrition messages, the team measured whether children's eating habits changed as a result of the Team Nutrition intervention. Three venues were focused on: home, media, and community. The team also conducted two cafeteria events, three parent activities, two chef activities, one community event, and one media event for the district (23). Parents'

involvement included mostly take-home handouts, but there were low turn-outs for the events. After completing the project, the USDA Team Nutrition staff suggested allotting abundant time for planning and implementing. Schools were found to be very supportive. In addition to intervention in schools, there are other venues for sharing the concepts of MyPyramid with children (23).

Preceding the development of the new MyPyramid, a study in an Oregon school used Team Nutrition materials. The four week study included both intervention (N=17) and control (N=23) third grade classrooms that completed pre and post-tests. The nutritional effect of the education program was observed in the lunch room and then analyzed (24). Informed consents were obtained prior to intervention and parents were asked to fill out questionnaires. Intervention students increased consumption of fruit, fiber ($p \leq 0.01$), and vitamin A ($p \leq 0.05$) from pre to post-intervention. A larger variety of fruits, vegetables, and grain products were also selected following the intervention, although this was not significant ($p > 0.05$). The study suggests that a nutrition education program using MyPyramid materials might have a similar or greater impact (24).

In After-School Programs

Few nutrition studies have been conducted in after-school settings. However, many schools are not willing to give up valuable time in the classroom for nutrition education, and after-school programs provide a good alternative. A pilot study on the Coordinated Approach to Child Health (CATCH) was conducted in El Paso and Austin, Texas to determine the effectiveness of its aim to improve nutrition and physical activity. The study included 16 after-school programs of elementary students (n=157, 61% retention rate), 3rd through 5th graders, divided into intervention and control groups (25). CATCH was designed for early prevention of cardiovascular disease. The program was based on the Social Cognitive Theory and included 15 lessons over 5 3-week units, incorporating nutrition knowledge, snack, and physical activity components. Lessons were 15 to 30 minutes, plus a physical activity component of at least 30 minutes. The study focused on healthy food choices for lunch, snack, and eating out; increased moderate to vigorous exercise at school, and prevention of chronic disease (25). Following assessment, children in intervention programs

increased (p=.001) moderate to vigorous physical activity at post-intervention compared to pre-intervention; they also reduced the amount of sitting (p=.125) or standing (p=.027) compared to children in control programs. The intervention group also showed a significant increase in food knowledge and a marginally significant ($p<0.10$) increase in fruit and vegetable consumption. Researchers found the study to be feasible, but with challenges, such as training the teachers. However, incorporating physical activity and teaching about healthy foods was effective (25).

Outside of School

In addition to nutrition education within the school and in after-school programs, parents can be targeted outside of school as they are a powerful influence on their children's diet behaviors and values. *We Can!* is a parent handbook from the US Department of Health and Human Services with the purpose to guide parents with children 8 to 13 years old (26). The handbook gives risks and reasons of why being overweight is not healthy. Encouraging a healthy weight can be accomplished through parents being role models and families setting good habits. Examples of this include encouraging walks and physical activity together, reducing fat intake, changing desserts, and including more vegetables in the diet (26). Parents have a large influence on the health and eating habits of their children. Teaching children in school is only one step to teaching a healthier lifestyle. With limited time and resources, information and nutrition pamphlets can be sent home with children for parents to read. MyPyramid.gov offers a handout with MyPyramid on one side and tips for families on the reverse side (4). Children can have an influence on parents just as parents have a definite influence on children concerning their diets. It is important, in order for an intervention to be effective, to incorporate the parents as much as possible.

Community intervention is another way to address health in addition to parent handbooks. Ten counties in California participated in the Expanded Food and Nutrition Education Program (EFNEP) and were followed-up for evaluation. The target audience of this randomized, controlled research study was low-income children ranging from 9 to 11 years old. Intervention was conducted by volunteer leaders of the community who were trained (27). The study included

intervention (N=3586) and comparison students (N=1526) with a large percentage of Hispanic students (43%). Lessons focused on fruits and vegetables in a healthy diet, and food safety, along with enhancing food knowledge and skills with games, activities, lessons, food tasting, and more. This large scale research study had advantages of an already existing program with willing students and leaders and a basic curriculum to use. Change scores were greater for intervention students compared control students regarding nutrition knowledge ($p<.0001$), food selection ($p<.008$), and food preparation and safety skills ($p<.0001$). The results indicate that low-income students can gain benefits from nutrition education employing various strategies (27).

Gaps in the Literature

After reviewing the programs and studies that have been completed in and out of schools, gaps remain that must be addressed in order to successfully teach healthy behaviors to children using MyPyramid. Very few studies have specifically focused on MyPyramid. Because of the way MyPyramid is formatted (i.e. computer based for individual use) there is a need to compare individual learning using written materials versus in-class materials and instruction in order to determine if the current format is appropriate for high risk students to change behaviors.

Additionally, within the school-based studies, there is an overall lack of randomization of schools and classrooms. Randomizing the schools can increase the strength of the study, along with basing the intervention on a behavioral change theory. Although some of the studies mentioned above do specify a theoretical framework, many studies do not.

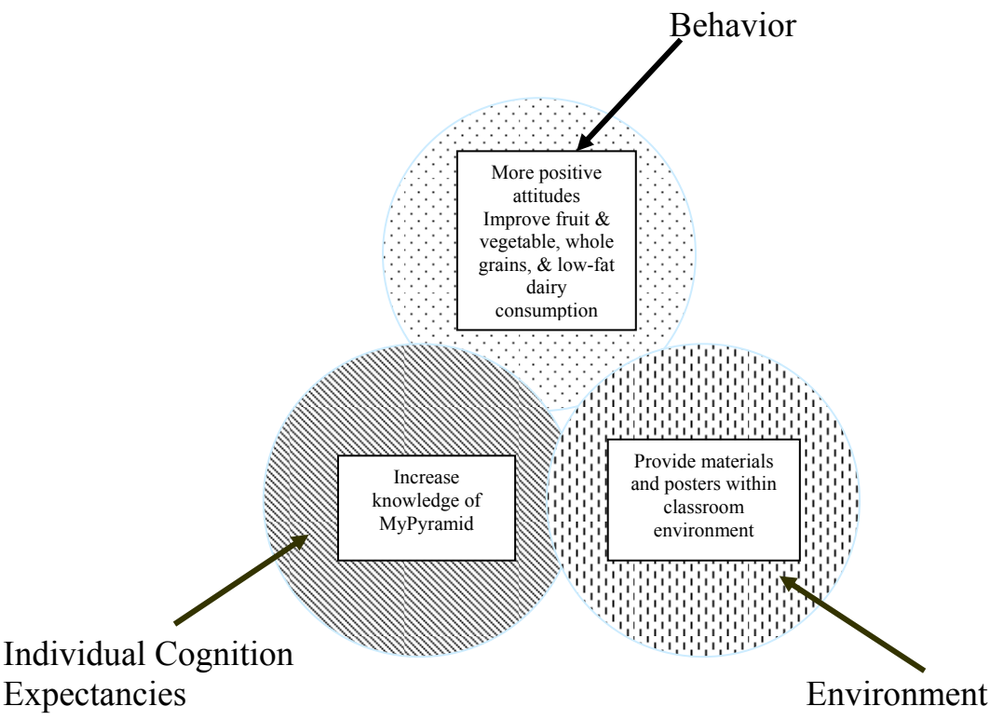
CHAPTER III

METHODS

Conceptual Framework

The theoretical basis for the pilot study lies in SCT. As noted previously, the SCT proposes that there are several interacting factors leading to a change in behavior. These interacting factors include the environment, individual cognition expectancies, and behavior (13).

Figure 2: Social Cognitive Theory Applied to *Step Up MyPyramid*

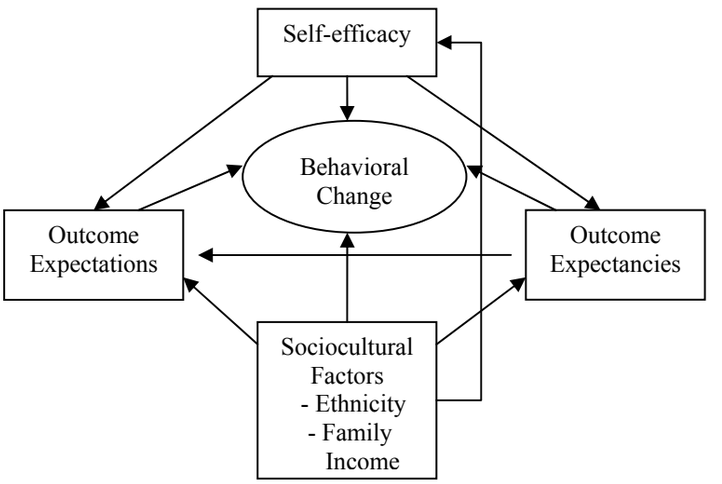


The Social Cognitive Theory's constructs have the power to influence each child as they apply to nutrition education. Students targeted for this study were selected from schools of disadvantaged groups. Changing their environment, enabling them as individuals, and influencing

outcome expectancies can change the behaviors and lifestyles of these children of diverse groups with diverse needs (13). Sociocultural influences of these children can be either impediments or facilitators. *Step Up MyPyramid* aimed to increase knowledge and belief in each student in order to make healthier decisions.

Specific constructs used were outcome expectations, outcome expectancies, self-efficacy, and sociocultural factors. Based on these constructs, the following conceptual model (Figure 3) was developed as a means for understanding behavior change among 3rd – 5th grade students.

Figure 3: Conceptual Model for Step Up MyPyramid



Outcome expectations such as an expectation to feel and be more prepared to be healthier may interact with outcome expectancies and sociocultural factors. Expectations are outcomes which are anticipated, while the values placed on those outcomes are referred to as expectancies. Outcome expectancies, such as healthier food intake behaviors, are influenced by ethnicity and family income. Self-efficacy reflects the feeling of capability, therefore influencing outcome expectancies and expectations, and being influenced by sociocultural factors. The interaction of all factors combined and individually may cause a change in behavior.

The following table indicates specifically how these constructs were addressed in this study.

Table 1: SCT Constructs within Study

Construct	Definition within study	Activities
Outcome Expectations	Students expected to feel healthier	Lecture on health & nutrition, along with the crossword, gave knowledge of what vitamins & nutrients found in various foods. These components protect from disease & give each student a higher quality of life. Students were given a chance to say why health is important & how it helps our bodies—heart, bones, eyes, weight.
Outcome Expectancies	Changing attitudes toward and eating more fruits, vegetables, whole grains, and low-fat dairy	By teaching about MyPyramid & its importance to each individual, we hoped to influence students' attitudes & behaviors in order to increase fruit and vegetable, low-fat dairy and whole grains consumption, and increasing physical activity each day. A 5-a-day worksheet challenged them to increase fruits & vegetables. The Food Math worksheet allowed diet planning to help students learn how to put these goals into practice and to understand how the body responds.
Self-efficacy	Confidence in ability to make healthy food choices	Explaining MyPyramid using the poster and amounts of each category needed gave students knowledge and skills, and therefore more confidence. Serving size portions and food labels were explained to give the students the tools necessary to determine the better food choices at appropriate amounts. The two worksheets, Steps to a Healthier You & Where's the Fat?, gave them practice at making healthy decisions so they were prepared to do this is daily life.
Sociocultural Factors	Behaviors can be improved despite their situation of low-income and racial/ethnic background. (cultural food, food security, free lunch students, family structure, eating habits)	A handout with healthy tips for families could influence choices in the home. Recipe for Success (See Appendix), a brochure for parents, gave them the option to send it in and receive more free tips for shopping and eating healthy both for parents & children. Children wrote a cultural food choice that is not healthy on paper. They listed healthier and better choices in order to learn how to make healthy decisions with available foods.

Approval and Recruitment Processes

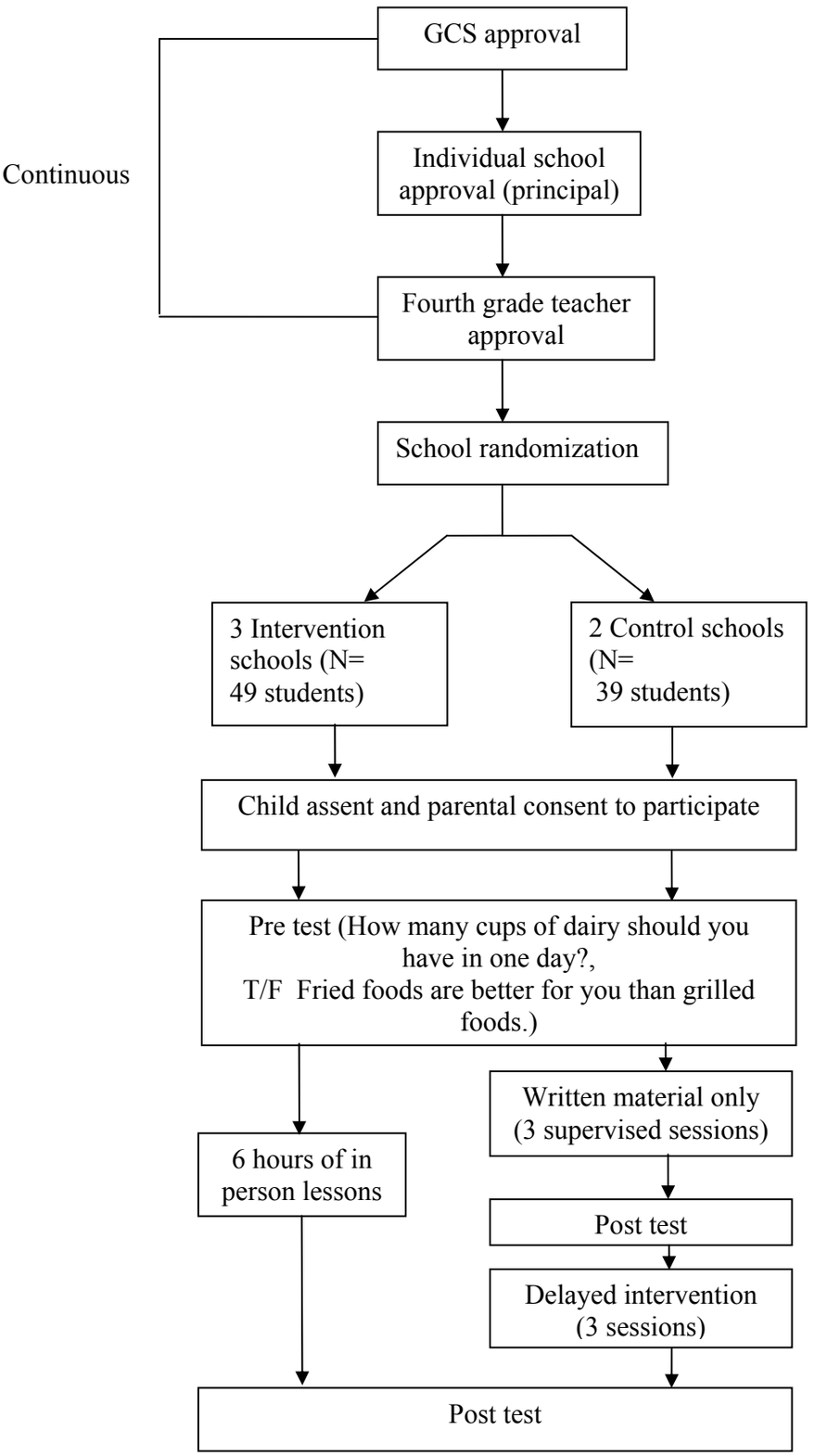
The Food Stamp Nutrition Education Grant awarded by the USDA was aimed at reaching elementary students in Guilford County. The title of the grant was Nutrition Education for New North Carolinians. New North Carolinians are newly arrived immigrant adults and children who have settled in the state of North Carolina. This grant focused on providing nutrition education, specifically MyPyramid, to limited resource elementary school aged children. One of the unique aspects of MyPyramid is the development of and ready access to materials designed specifically for children on the key components of the MyPyramid guidance system. As a result of this, schools served as an effective environment for reaching children. To initiate this project, a packet was assembled to present the proposed project to the Guilford County School district. Contents included a cover letter, title page, abstract, research application summary form, consent forms, and materials to be used.

The purpose of this study was to test in-class instruction verses provision of only written material on improvement of diet and physical activity knowledge, attitudes, and behaviors of 3rd-5th graders in the Guilford County School District. Several schools were selected to participate in the study. The list of schools was obtained from the county school board; these included the county schools with the greatest percentage of free or reduced-price lunches and the largest majority of Latino students (new North Carolinians) (28). These schools were selected in order to focus the research on low-income, limited resource children. Of the low-income schools, those with the highest percentage of Latino children were chosen for recruitment in order that new immigrants and an ethnically diverse population be reached.

The first step in this school-based pilot study, *Step Up MyPyramid*, was to apply for and receive approval from the school system. Approval was received March 28, 2007. Following approval, each school's principal agreed to have their school participate. The next step was for each classroom teacher to agree to participate (See Figure 4– Recruitment and Randomization).

Contacting teachers directly was the most effective and fastest route to access students in several cases, followed by principal approval upon the teacher's request.

Figure 4: Recruitment and Randomization



Following approval from the Guilford County school system, an Institutional Review Board (IRB) application was submitted to UNCG for approval. IRB approval was received April 27, 2007. Data collection for the intervention only took place with the students whose parents had signed and returned a consent form and the students had signed a child assent form. Classrooms consisted of anywhere from 18 to 26 students. Each of the targeted elementary schools was contacted by sending an information packet to each principal. A phone call to the principal followed up the packet after the principal had an opportunity to review the information. If desired by the principal, a meeting was set up to discuss study specifics. If they did not respond to the phone call, an email was also sent. Individual teacher approval followed principal approval usually. The order of contact differed for some schools. The first school to agree to participate was classified as an intervention school. Randomization was achieved by alternating intervention and control schools as approval was granted. Two consent forms were sent home with each student, as distributed by their teacher. Ideally, the parent retained one copy and the other signed form was returned to the teacher which in turn was returned to the project director. Consent forms were available both in English and Spanish, depending on the child's household language. The copy sent home was determined by the teacher. Times and dates varied for each classroom depending on the teacher's schedule and the length of time necessary to receive consent forms back from the parents. The goal for returned consent forms was one to two weeks.

Study Design

The following describes the specific study methodology. Instruction took place for a total of six hours, 1 hour sessions either once or twice a week for 6 or 3 weeks, respectively. Once an intervention school agreed to participate, the next school to agree served as a control. All students participating (both intervention and control) took a pre-test (See Appendix A) prior to the study to determine their level of MyPyramid knowledge, diet choices (f/v, low fat dairy, whole grains), physical activity behaviors, and attitudes toward eating healthy. Pre/post test forms were content validated by nutrition professionals (N=4). Details of each of the six lessons are listed in Table 2.

Intervention Classrooms

Intervention participants were administered a pre-test at day 1 of contact. Six lessons followed that incorporated the lessons of MyPyramid (table 2). All intervention classrooms completed the same material in the 6 total lessons. Lessons plans and materials are listed in Appendix B. Instruction and lessons were implemented using MyPyramid materials. The frequency of lessons depended upon each school's schedule. Schools agreed to lessons either once or twice a week. Upon completion of the 6 lessons in the intervention classrooms, a post-test was given to students to determine if knowledge of MyPyramid; fruit, vegetable, low-fat dairy and whole grain consumption, physical activity, and positive attitudes regarding all these had increased.

Control Classrooms

The original plan was for the control schools to complete MyPyramid worksheets at home. However, worksheet completion could not be regulated or enforced within the students' homes. In order to improve completion, control worksheets were completed in the classroom. Additionally, schools had very limited time to devote to this project. Therefore, a new direction was taken with control classrooms. Control classes were given a pre-test at day 1 of contact. Students were given the same materials/worksheets as the intervention group to complete in three supervised sessions while being monitored without instruction. A post-test followed on the 3rd session. The post-test was given to students to determine if knowledge of MyPyramid; fruit, vegetable, low-fat dairy and whole grain consumption, physical activity, and positive attitudes regarding all these had increased.

After the completion of the first 3 supervised sessions, the next 3 sessions were used for delayed intervention. Therefore, a total of 6 sessions was used, but this included the control section and delayed intervention so schools were not required to increase the amount of time they participated in the study. This took the place of the original plan to carry out the control activities in 6 sessions and then come back to the schools to provide a delayed intervention.

Research Assistants

Four research assistants assisted in the majority of classrooms. In the intervention classrooms, the research assistants helped maintain or control classroom behavior and focus, or if students needed extra help or explanation. Assistants were trained by the principal researcher with the materials. They monitored or taught in control (N=1) and intervention (N=1) classrooms. Assistants were not always present in the classroom.

Table 2: Lessons for *Step Up MyPyramid*

Day	
1	Students took pre-test to determine initial knowledge and behaviors. A poster of MyPyramid was used to introduce all the components. Students filled out a blank MyPyramid in order to increase knowledge and self-efficacy.
2	An initial game taught determination of healthy and unhealthy choices of foods and activities. A lecture gave an overview of the essence of health and nutrition. A crossword allowed learning vocabulary and the benefits of healthy food choices.
3	A handout was read aloud by students for healthy tips for them and their families. Steps to a Healthier You, a worksheet, demonstrated the importance of varying fruits and vegetables in the diet. A 5-a-day worksheet challenged the students to make goals in order to do increase their fruit and vegetable intake.
4	A food label exercise and worksheet explained reading and understanding food labels. Using food labels, the worksheet, *What's the Score,* taught students about low-fat dairy consumption and how to increase consumption. A *Where's the Fat?* worksheet taught them to determine the fat from foods and how to choose between two options for a healthier choice. The outcomes of an unhealthy lifestyle were described to the students and encouraged them to influence their family in healthy choices.
5	Serving sizes were explained and examples were given with food models, measuring cups, and other tools. A Food Math worksheet allowed students to work together and create a menu with the correct amount of servings for each food category. Physical activity was emphasized and students discussed activities and ideas of how to do these during the day.
6	Review MyPyramid and lessons. Play a food group game with students to emphasize healthy choices. Students then completed a post-test to determine increased knowledge and change in behavior.

Data Analysis

All data were entered into SPSS v. 14.0 and analyzed between intervention and control groups and within both groups. Level of significance was $p < 0.05$. Descriptive statistics were used to examine demographic characteristics (age, gender) of both groups.

The pre/post test consisted of questions regarding nutrition knowledge, attitudes, and behavior. There were 2 questions focusing on students' attitudes toward nutrition and physical activity, 3 on physical activity behavior, and 17 questions focusing on nutrition knowledge. The variables used for all analyses are found in Appendix C. An additional table was included for students to fill out foods, listed by food group, eaten the previous day.

Knowledge

A large part of analyses included the knowledge variables. The following table (Table 3) outlines each knowledge question according to the percentages of controls and intervention subjects who answered correctly or incorrectly. This preliminary analysis was conducted to determine which knowledge variables would be included in the final analysis. The statistics column describes the percent of intervention and the percent of control subjects out of the total participants who answered correctly, and the percent of each who answered incorrectly. Variable discussion estimates why these percentages were observed. The discussion gives an idea as to why differences existed between groups. Despite preliminary testing of the material, some knowledge questions were either too simplistic or too difficult leading to high corrects or incorrects on certain answers. For example, 89% of total subjects answered correctly on the healthiest drink question. Therefore, because of the lack of variability, if 85% of participants answered correctly or incorrectly on a variable, the question was excluded from analysis. The researcher and statistics expert chose an 85% cut off in order to identify variables that would provide the most variability. Excluded variables (highlighted) included healthiest drink, fried foods, and whole grains.

Table 3: Nutrition Knowledge Variable Descriptives

Pre-test Question/ Variable	Statistics		Variable Discussion
	Intervention (N=49)	**Control (N=39)**	
A correct serving	Intervention had much larger % incorrect (75%) between groups		Previous exposure to MyPyramid could have influenced answers.
Healthiest drink choice	89% of total students scored correctly		The majority of correct answers could be due to the nature of the question. It is a question that is more common sense, without required knowledge of MyPyramid.
Fried or grilled foods	87.9% of total students answered correctly		
MyPyramid stripes	63.7% of total students answered correctly, larger contribution of intervention students		The format of the question was different—circled the answer within the sentence instead of multiple choice. This could have lead to confusion. Width of stripes correlates to previous exposure of MyPyramid.
Cups of dairy recommended daily	63.7% of total answered incorrectly, with a large majority of those as intervention		A large percentage of incorrect answers could be due to lack of MyPyramid knowledge, a lack of understanding of cups as servings, or lack of understanding of dairy.
One cup serving	About even distributions for total students for incorrect or correct, but large percent of interventions answered incorrectly (70%)		Interventions may have no exposure to the meaning of serving size.
Cups of fruits & vegetables	64.8% of total students answered incorrectly, larger contribution by intervention students		Incorrect answers are related to lack in MyPyramid knowledge, especially serving sizes given in cups. At least one control classroom had received previous exposure on MyPyramid.
Recommended active minutes per day	About even distributions for total students for incorrect or correct, but large percent of interventions answered incorrectly (69.2%)		Intervention students may have had less understanding of the term "physical activity" or less knowledge of recommendations.

Vitamins in fruits & vegetables	65.9% of total students answered incorrectly, larger contribution of intervention students	Question may have been confusing for students with a choice that includes all choices (i.e., both of the above)
Milk nutrients	60% of total students answered incorrectly, larger contribution of intervention students	Question may have been confusing for students with a choice that includes all choices (i.e., all of the above)
Whole grains	89% of total answered incorrectly	"Whole" was in a question of fill in the blank style which may have not been optimal for 4th graders. They also might not have understood what whole means or had any previous exposure to this.
Correctly label grains/ Orange	71.4% of total answered incorrectly—about equal for both groups	Structure of the question may have been confusing or made it less apt for students to answer since it was not multiple choice. Students may have not been exposed to the MyPyramid, varying individually and by school.
Correctly label vegetables/ Green	80.2% of total answered correctly, about evenly in both groups	
Correctly label fruits/ Red	68.1% of total students answered incorrectly, with greater contribution of intervention students	
Correctly label oils/ Yellow	69.2% of total students answered incorrectly, with greater contribution of intervention students	
Correctly label dairy/ Blue	About equal distribution for total students for incorrect and correct, but greater contribution of incorrect response by interventions (66%)	
Correctly label meat & beans/ Purple	73.6% of total answered incorrectly	

*Percentages calculated with descriptive statistic's crosstabs

After exclusion of 3 questions or variables (highlighted in table 3), there were a total of 14 knowledge questions left for analysis.

Missing Value Analysis

Due to student self-completion of pre and post tests, several tests had missing data. Using SPSS, missing values analysis was used to estimate pre/post test answers based upon age, gender, and existing answers. The procedure of missing values has three primary functions:

• pattern description of missing data: location and extent of missing values, missing values of paired variables within different cases, any extreme missing values, and any randomly missing values

• "Estimation of means, standard deviation, covariances, and correlations using a listwise, pairwise, regression, or EM (expectation-maximization) method"

• use of regression or EM methods to impute missing values with estimated values (29)

Incomplete data can cause results to have extremes or obscurities. By running missing values analysis, calculated statistics are more precise because all information is complete. Complete cases allow theories to be applied and to obtain conclusions (29).

Missing values were imputed in this case using expectation maximization (EM) estimation. Each question had at least one student with a missing value. This ranged anywhere between 1 to 65% missing values for specific questions. Means and analyses were conducted prior to imputing missing values; they were analyzed again following imputation. There were no extreme differences in data due to missing value analysis. A statistics expert also aided in the decision process. Due to imputation of values, the complete (N=91) sample's information could be analyzed.

Prior to data analysis, t-tests and Chi square analyses were conducted to determine baseline differences in age, gender, or knowledge, attitudes, and behaviors.

Nutrition Knowledge Score

Once there was complete information for each participant, a nutrition knowledge score was computed. Fourteen knowledge questions were included in the nutrition knowledge analysis and compiled into a score. Each question was categorized as correct or incorrect. For every correct answer, students received 1 point; the nutrition score was a sum of these correct answers. Scores could range anywhere between 0 and 14, with 14 being the highest indicating all correct responses.

For each group, control and intervention, a mean nutrition knowledge score was calculated. The mean nutrition knowledge score gave the average of total students' scores at pre and post-intervention.

Between groups

Nutrition knowledge, attitudes, and behaviors were compared between intervention and control groups. A student's t-test was used to compare means for the continuous variables between schools—nutrition knowledge score, and number of servings of fruits, vegetables, dairy, and grains. To compare categorical variables, chi square tests were conducted. Categorical variables included individual knowledge of MyPyramid questions, physical activity, and attitudes about fruit and vegetable, dairy and grain consumption and physical activity.

Within groups

Paired t-tests were conducted to compare pre- and post-test nutrition knowledge mean scores within each of the two groups. To further understand knowledge and mean scores, each question was explored. For each group, the percentage of students who answered correctly on knowledge questions was analyzed at pre and post-test. The knowledge questions were categorical variables defined as (1) correct and (2) incorrect. Frequency analysis was used to identify which students, for each question, answered (1) correctly at pre and post, (2) incorrectly at pre and post, (3) incorrectly at pre and correctly at post, or (4) correctly at pre and incorrectly at post. This information is included in Appendix D.

Behavior

Students answered multiple choice questions regarding physical activity and exercise behaviors. These were quantified as the number of days students participated in physical activity or number of competitive activities. For dietary behaviors, the pre/post test included a table with each food group listed and a box to check if students ate any foods from that group the previous day. There was also a box to list the actual foods eaten, along with the type of exercise completed, if any.

Food intake was self-reported. Students recorded foods eaten within the correct food group for all meals of the day.

Preliminary Data

In order to better develop the pilot study, a preliminary study was conducted. The study offered a chance to test and improve methods and materials. Preliminary studies were conducted in two elementary schools with fourth and fifth graders (N= 43). The purpose of these studies was to determine the best methods for teaching the MyPyramid material and to determine how well it was accepted and retained. Using a similar protocol as the primary study design, seven schools were contacted. Two agreed to participate. Students from two elementary schools in Guilford County Schools were used to test the study design and materials prior to developing the larger study. The two classrooms had a total of 43 students.

Table 4: Preliminary Subjects' Characteristics

Subject Characteristics (N=43)	
Age	10-11yo
Gender	
Males	23
Females	20
Ethnicity	
Latino	4
African American	39

Only 27 students returned parental consents (63% return rate). Students were not asked for ethnicity. However, ethnicity was able to be estimated and collected by observation in the classroom. As a result of these findings from preliminary classrooms, several changes/improvements were made to the proposed study design in order to alter and improve teaching methods and materials (Table 5).

After giving the pre-test, it was clear due to test results and classroom observation that adjustments had to be made in order for the test to be more user-friendly. The worksheets that were a

part of the pre-test were too detailed and confusing for the students to complete. For example, one of the three worksheets was very time consuming with a confusing format. The worksheet gave a place to fill in foods from each meal, the food groups it included, the estimated serving sizes in cups and ounces, along with food goals for the next day. Instead of expecting the students to fill in a blank food pyramid, this worksheet was modified to contain questions asking what each color means in the pyramid, how much of each food category was eaten, and what exercise was conducted the day prior. Some wording was adjusted with anticipation that it could be read more easily.

Other necessary changes included critiquing and adjusting the lessons. One of the biggest obstacles was finding a way to get and maintain the students' attention. Use of worksheets only caused the children to lose focus and not pay attention, especially as participation in this study was not part of their school grade. Thus, some lesson plans were altered to add more activities as time allowed. Flexibility was needed depending on each classroom. Nutrition education and knowledge games were added, along with the children reading handouts out loud so that they would all follow along. Food models were added for explaining serving sizes and keeping students' attention. The last day, an activity was incorporated in order to try to get the students thinking of ways to substitute unhealthy foods for better choices. All of these alterations were made in the larger study to allow the students to gain more from the MyPyramid lessons.

Table 5: Changes Resulting From Preliminary Data/Pre-Intervention Collection

Original Pre/Post-Test & Lesson Plans	**Revisions**
Blank pyramid	Questions added to match color with food group
Yesterday's choices worksheet	Simplified chart added to list what food and physical activity choices made yesterday
Not many students completed full pre or post-test	Explain expectations for test clearly
Use of worksheets only	Added more activities Added nutrition education games
Explanation of foods, serving size	Use of food models (included culturally relevant models)
Low return rate of parental consents	Provide incentives for classrooms to return consent forms

CHAPTER IV

RESULTS

Collection of parental consent forms proved to be a difficult task. Return rates were very low initially in the majority of participating classrooms. Numerous actions were taken to encourage more returned parental consent forms: 1) New forms were sent home a second or third time if the student had not returned one, 2) Forms were placed in student folders that were sent home weekly normally, 3) Prizes such as pencils, magnets/picture frames, and pedometers were used as incentives to have the students return forms, and 4) Forms were encouraged to be returned regardless of a deadline.

Five of twelve schools agreed to participate in the study. Five classrooms were recruited and contacted with a total of 199 students. At completion of the study, 91 students had returned parental consent forms (45.7% return rate). Students included 3rd and 4th graders. Data presented include only the students with returned parental consent. Child assent forms were obtained at the time of intervention from all participating students. Three students were excluded due to outlying ages. Outlying ages included two 8-year olds and one 12-year old. Therefore, the final study sample was N=88 (controls = 39, intervention = 49).

Data on the percent of Latino students in the classroom was not able to be collected. Due to the ages of the participants, accurate reporting of ethnicity was not anticipated. The ethnic make-up of the schools could be obtained; however, this was not necessarily an actual representation of each classroom's composition. Therefore, estimation of ethnicity was obtained through observation of students in the classroom.

Study participants (N=88) were between the ages of 9 and 11 years old. Chi square analysis found a significant difference for age in controls versus intervention (p=.001); controls were older than intervention group children.

Table 6: Intervention Subject Differences

Subject Characteristics			
	Intervention (N=49)	**Control (N=39)**	**P-value**
Age (average)	9.24 years	9.59 years	.001
Gender	30 F, 19 M	19 F, 20 M	.241

*p<0.05

Nutrition knowledge, attitudes, and behaviors were compared between and within intervention and control groups. Significant baseline differences were found for age and pre-test scores. These were adjusted for in between group analyses.

Between Group Differences

Knowledge

Mean nutrition knowledge pre-scores were significantly different ($p<0.05$) between controls (7.564) and intervention students (5.306). Post-intervention scores showed an increase in both groups—controls with a mean post score of 9.282 and intervention classrooms with a mean post-score of 7.612. Scores on the post-test between the two were also significantly different. Table 7 gives the unadjusted nutrition knowledge mean score of all students at pre and post-intervention.

Table 7: Unadjusted Mean Nutrition Knowledge Scores

Nutrition Knowledge Score	Control	Intervention	P value
Mean Pre-score	7.564 ± 2.38	5.306 ± 2.06	.000
Mean Post Score	9.282 ± 2.93	7.612 ± 2.70	.007

*p<0.05, Student's t-test used for analysis of means with standard deviation

Mean scores were adjusted for age and pre-test scores using univariate analysis of covariance. Adjusted post-scores of nutrition knowledge increased from pre-scores. Controls scored 8.722 and interventions 8.018. Table 8 provides the mean scores following adjustment for age and pre-scores. There was no significant difference between groups following adjustment.

Table 8: Adjusted Mean Nutrition Knowledge Scores

Nutrition Knowledge Score	Control	Intervention	P value
Mean Post Score'	8.772 ± .462	8.018 ± .405	.254

*p<0.05, Student's t-test used for analysis of means with standard error
'Adjusted for age and Pre-score

Attitudes

Students were asked two questions regarding their attitudes about healthy eating and physical activity on the pre/post-test. The first asked if being healthy was important to them and the second asked if physical activity was important. Answers were ranked as very important (1), somewhat important (2), or not important at all (3). The majority of students in both the intervention and control classrooms ranked both health and physical activity as either very or somewhat important. These rankings did not change from pre to post-intervention.

Table 9: Changes From Pre to Post in Attitude Variables

Attitude Variable	Intervention (N=49)		Control (N=39)	
	Pre N (%)	Post N (%)	Pre N (%)	Post N (%)
Being Healthy				
Very important	45 (92)	45 (92)	29 (74)	25 (64)
Somewhat important	2 (4)	4 (8)	10 (26)	13 (33)
Not important at all	2 (4)	0 (0)	0 (0)	1 (3)
Physical Activity				
Very important	32 (65)	30 (61)	30 (77)	28 (71)
Somewhat important	16 (33)	19 (39)	9 (23)	10 (26)
Not important at all	1 (2)	0 (0)	0 (0)	1 (3)

*Simple frequency analysis

Physical Activity Behavior

Participants answered two questions regarding their exercise behaviors in the previous two weeks (refer to Appendix B). Responses were given categorically and are as follows: none, 1-2 days, 3-5 days, 6-8 days, 9 or more days. One question asked for the number of sports or activities in which they participated the past 6 months: none, 1 activity, 2 activities, 3 activities, or 4 or more

activities. Table 10 outlines the number of students who responded according to each category between controls and interventions. The majority of students reported hard exercise occurred either between 1-2 days or 3-5 days in the intervention group. Within the controls, there was a larger majority in the categories of 3-5 days or higher. The largest proportion of students from both groups answered they performed light exercise 1-2 days or 3-5 days in the past two weeks. The greatest number of participants were involved in 2 or greater competitive sports or activities. No statistically significant differences between groups were found from pre to post in any of the three behavior questions. Yesterday's physical activity was also reported by students. Intervention participants reported an average of .3878 activities at pre and .3673 activities at post. Controls' activities averaged .6410 at pre and .5641 at post. Neither of these was significantly different between groups (p=.097 pre, p=.188 post).

Table 10: Change from Pre to Post in Physical Activity Variables

Exercise Variables	**Intervention (N=49)**		**Control (N=39)**		**Chi-Square**	
	Pre N (%)	**Post N (%)**	**Pre N (%)**	**Post N (%)**	**Pre**	**Post**
Hard Exercise						
None	2 (4)	3 (6)	2 (5)	0 (0)		
1-2 days	14 (29)	17 (35)	5 (13)	5 (13)		
3-5 days	17 (35)	13 (27)	15 (39)	16 (41)	.395	.062
6-8 days	9 (18)	9 (18)	7 (18)	10 (25)		
≥ 9 days	7 (14)	7 (14)	10 (25)	8 (21)		
Light Exercise						
None	8 (16)	9 (18)	4 (10)	3 (8)		
1-2 days	20 (41)	16 (34)	16 (41)	18 (46)		
3-5 days	12 (25)	9 (18)	13 (33)	12 (31)	.850	.170
6-8 days	7 (14)	11 (22)	5 (13)	4 (10)		
≥ 9 days	2 (4)	4 (8)	1 (3)	2 (5)		
Sports or Activities						
None	5 (9)	7 (14)	6 (16)	6 (16)		
1 activity	6 (12)	8 (16)	5 (13)	2 (5)		
2 activities	12 (25)	9 (18)	8 (21)	10 (25)	.870	.514
3 activities	10 (20)	8 (16)	10 (25)	7 (18)		
≥ 4 activities	16 (34)	17 (35)	10 (25)	14 (36)		

*p<0.05, Chi-square analysis

Dietary Behavior

Table 11 gives the average number of servings of each food group reported by participants in both groups at pre- and post-test. Overall, there were a very low number of servings reported in each food group. All food group servings decreased from pre to post in both groups. Significant differences were found between groups at pre and post in the number of grain servings and the post number of fruit servings.

Table 11: Dietary Behavior Reported by Group

Yesterday's Behavior (No. of MyPyramid recommended servings per day)	Intervention		Control		P-value	
	Pre	Post	Pre	Post	Pre	Post
Grains (6 ounces)	.5306	.4286	.8718	.7179	.020*	.040*
Vegetables (2.5 cups)	.8367	.3878	.7179	.5385	.444	.232
Fruits (1.5 cups)	.8980	.4490	1.0513	.9231	.288	.007*
Oils (limit: 5 tsp. or ≤ 195kcal fats/sweets)	.4490	.2041	.5897	.5385	.425	.069
Meat (5 ounces)	.8367	.3673	.9487	.5385	.413	.143
Dairy/Milk (3 cups)	.6735	.4490	.8718	.6410	.104	.128

*p<.05, Student's t-test was used to compare mean serving intakes between groups

Within Group Analyses

Knowledge

Within group analyses were conducted to identify changes in the targeted variables within each group. Nutrition knowledge scores for each group are shown in Table 12 and 13. A significant difference at post-test for nutrition knowledge scores were found in the intervention group. Nutrition scores significantly improved from 5.306 to 7.612 in intervention participants.

Table 12: Intervention Nutrition Knowledge Score

Nutrition Knowledge Score	Intervention	P value
Mean Pre-score	5.306 ± 2.06	.000
Mean Post Score	7.612 ± 2.70	

*p<0.05, One sample t-test used for analysis of means with standard deviation
Mean scores based on 14 questions

There was a significant difference at post for nutrition knowledge scores in the control group. Nutrition scores significantly improved from 7.564 to 9.282 in control participants.

Table 13: Control Nutrition Knowledge Score

Nutrition Knowledge Score	Control	P value
Mean Pre-score	7.564 ± 2.38	.000
Mean Post Score	9.282 ± 2.93	

*p<0.05, One sample t-test used for analysis of means with standard deviation
Mean scores based on 14 questions

In examining nutrition knowledge, intervention students improved more than controls. Intervention students had a greater improvement in nutrition knowledge. Table 14 includes the percent change for each nutrition knowledge question within both intervention and control groups.

Table 14: Correct Response Change for MyPyramid Knowledge Variables

	Intervention (N=49)			Control (N=39)		
Variable	**% Correct at Pre**	**% Correct at Post**	**% Change**	**% Correct at Pre**	**% Correct at Post**	**% Change**
Correct serving	49.0	59.2	10.2	76.9	66.7	-10.2
Stripes	59.2	85.7	26.5	69.2	82.1	12.9
Cups of Dairy	24.5	44.9	20.4	51.3	61.5	10.2
One cup Serving	44.9	38.8	-6.1	69.2	61.5	-7.7
Fruits & Veggies	32.7	65.3	32.6	41.0	71.8	30.8
Active Minutes	46.9	55.1	8.2	69.2	61.5	-7.7
Vitamins	26.5	28.6	2.1	43.6	56.4	12.8
Milk	32.7	20.4	-12.3	48.7	35.9	-12.8

Orange	28.6	49.0	20.4	28.2	66.7	38.5
Green	75.5	77.6	2.1	84.6	89.7	5.1
Red	26.5	69.4	42.9	38.5	71.8	33.3
Yellow	20.4	69.4	49	43.6	74.4	30.8
Purple	24.5	49.0	24.5	30.8	56.4	25.6
Blue	38.8	49.0	10.2	61.5	71.8	10.3

*Simple frequencies were used to calculated percentages.

The majority of questions showed an improvement in both intervention and control classrooms. As an exception, in both the intervention and control groups, a lower percentage of students answered the milk and one cup serving questions correctly at post-test. Controls also decreased on correct serving and active minutes. Within the intervention classrooms, large increases in the percent of correct answers were seen with the stripes question, fruits and vegetables question, and some of the color representations of the stripes of MyPyramid.

In order to further understand the change seen within the groups, for each individual knowledge question frequencies were used to identify: 1.) the percentage of students who answered pre/post questions both correctly, 2.) the percentage of students who answered pre/post questions both incorrectly, 3.) the percentage of students who answered incorrectly at pre and correctly and post, and 4.) the percentage of students who answered correctly at pre and incorrectly at post. These tables and graph are attached in Appendix C.

CHAPTER V

CONCLUSIONS

Discussion

The purpose of this study was to compare in class instruction versus written material only focusing on MyPyramid concepts of diet and physical activity; knowledge, attitude, and behavior changes in elementary school students. The specific objectives for students receiving in class instruction included: increasing MyPyramid knowledge, increasing consumption of fruits, vegetables, low-fat dairy, and whole grains; increasing physical activity, and reporting more positive attitudes regarding nutrition and physical activity.

The low return rate of parental consent forms limited the sample size for this study. There are several possibilities for why these forms were not returned. Teachers were in charge of sending home the consent forms and collecting them upon return. Therefore, there was little control by the researcher over this process. The importance of the study to the teacher had an influence on their involvement and encouragement of students to return forms. In some schools, the participation in this study was required by the principal; however, if the teacher did not have a vested interest, consent forms were not deemed a priority. In other schools, teachers valued nutrition and tended to encourage students more to return forms. The characteristics—teacher-parent communication, level of organization of the classrooms and schools—likely influenced the amount of parent response. Additionally, parents may not have received forms or discarded the form without attention. Incentives offered to the students did help to encourage them to have their parents sign the form, although this was not true for a large number of students. Incentives included pencils, magnets/picture frames, and/or pedometers. Control schools had a higher consent return rate compared to intervention students. The lack of consent largely influenced the sample size of the

study. Only 91 of 199 students returned signed parental consent forms. Low parental support or participation in studies is not uncommon. Georgiou found low response rates by parents to questionnaires, but did not directly address informed consents (24). Although parental consents have not been addressed directly in many studies, some studies report low parent participation resulting in low final sample sizes (23, 30). The return of parental consents is essential when working with elementary school students.

Of the total 91 students with returned consent forms, missing value analysis was necessary to account for the large number of questions that were not answered by students. Time restriction, misunderstanding, and/or lack of knowledge could all have contributed to skipped questions or missing information. Each classroom was different, varying in the level of organization and stability. The atmosphere of the classroom was influential on the students and their ability to focus on the pre/post test and its thorough completion. For instance, noise level, announcements over the speaker system, movement of students, various lengths of time needed to finish for each student, and lack of comprehension all contributed to the high level of missing data. If a student did not know the answer, particularly at pre-test, it was skipped. Several students were not fluent in English. In this case, sometimes other students translated the question (which is how this is handled for regular school work) for them or it was skipped. Results of the intervention schools compared to the controls were unexpected. One of the main objectives of this study was to assess improvements in nutrition knowledge between intervention and control groups. Despite baseline differences between groups in knowledge, control and intervention students both improved their nutrition knowledge. Intervention students, however, had a greater increase in knowledge than controls. Similarly, Townsend et al. found intervention students scored higher on evaluation than comparison students in nutrition knowledge, safety and preparation of food ($p<.0001$), and food selection ($p<.008$) (27). Their study was comprised of low-income children 9-11 years old, but with a much larger sample (N=3586). Scores increased for Eating a Variety of Foods, nutrition knowledge, and food selection. Only small gains were evident however due to high pretest scores (59% of answers correct at

baseline) (27). Results from our study support those results for some knowledge variables (table 3). Baseline knowledge scores were high for active minutes recommended, healthiest drink, stripes, and the green stripe of MyPyramid for all students. Overall, an improvement of nutrition knowledge was achieved within the intervention group regarding most of the questions following instruction. Control subjects improved also, at a higher percent than expected. Other studies have reported differing results with experimental groups improving more than controls (11, 20, 27).

Nutrition knowledge has been similarly addressed in other studies. Willeford et al. evaluated a 6-week curriculum in 4th through 6th graders (18). All students had significant increases from pre to post-intervention with all students receiving instruction. This increase in nutrition knowledge correlates with our intervention group findings. Researchers also found that the gains were much higher for 4th graders as compared to 5th and 6th graders (18). The majority of students in this study were 3rd and 4th graders, with the control group only consisting of 4th graders. Willeford et al. gave one reason for greater gains as the readiness to change was much higher in 4th graders. This might be true when looking at a sample of 3rd and 4th, with 4th graders being more ready to change and comprehend nutrition knowledge. Studies by Powers et al. and Robertson et al. randomized students into treatment and control groups (11, 20). Nutrition knowledge increased significantly in the treatment groups compared to controls. Nutrition Pathfinder (treatment) participants improved Food Guide Pyramid knowledge by 54% compared to a 41% improvement of control participants (20). Nutrition knowledge increased for determining which food did not belong in which food group, nutrient food association, and specific nutrient's job (11). Some of these topics were addressed in Step Up MyPyramid. Of the 14 nutrition knowledge questions, intervention students improved from pre to post test on 12 and the control group improved on 10. This was a large increase for the control group and was unexpected. Powers et al. found dissimilar results as the treatment group increased on all 16 knowledge questions from pre to post-intervention compared to controls who increased on only 1 question (11). They also found a weak correlation for both in gains of knowledge compared to gains in behavior (11). Robertson did not find significant improvements in

attitudes, although gains in knowledge did occur in individuals receiving a nutrition education intervention that focused on the food pyramid and physical activity during a 3-day camp (20).

Another objective of this study was to improve attitudes toward healthy eating and physical activity. Almost the entire 91 students rated being healthy and physical activity as very or somewhat important at baseline. At post, there was no significant improvement in attitudes due to the high level of importance originally reported by students. This is encouraging for nutrition educators as students indicate they prioritize being healthy and are therefore hopefully open to nutrition instruction. In contrast, Willeford et al. reported a significant increase from pre to post regarding nutrition attitudes (18). Attitudes started high and remained high as students reported valuing health as important in our study. This is an important step in affecting healthy behaviors.

Behavior objectives for this study included increasing the consumption of fruits, vegetables, low-fat dairy and whole grains, and increasing physical activity among intervention students. Behavior questions addressed past and recent physical activity and the previous day's food choices. Reported frequency of exercise and sports activities did not differ significantly between groups at post test. The opposite was found in the CATCH study with intervention participants increasing significantly regarding observed physical activity (25, 31).

Consumption of the number of servings of each food group—grains, vegetables, fruits, oils, meat, dairy— decreased in both intervention and control groups at post-test (Table 11). Many children struggled with remembering the previous day's food choices both in type and amount. A simple level of understanding of reporting food choices led to students filling out the chart with usually only one food per food group instead of listing all the foods eaten. The chart of food choices from the previous day were insufficient and not likely representative of actual consumption. This reported decrease in food servings was not expected. These findings are different from those of other studies following nutrition education. Domel et al. found experimental students increased fruit consumption (>50%) compared to control students (17%) (12). Overall, fruit servings were still low even though servings increased. Fruit servings consumed were less than 1 per day as seen in our

study. Due to the lack of significant changes and low intake, a more comprehensive approach involving the school environment and the community was suggested (12). Although this study did not focus on variety, Georgiou found a 4-week nutrition education program positively influenced intervention subjects to consume a larger variety of fruits, vegetables, and grains, with a much smaller change seen in controls (24). Another study found a significant increase in fruits for the treatment group, along with an increase in fiber and vitamin A after a nutrition education program (27). Nutrients and components of food were not analyzed for Step Up MyPyramid. Students in these low-income schools reported low consumption of all food groups at pre and post test. Low consumption was also found in other studies of elementary students. Following the CATCH program, mean adjusted intake of fruits and vegetables was low in 5th graders—2.13 servings of fruit, and 1.91 servings of vegetables. There were no differences found in fruit or vegetable consumption following intervention (31). Regarding some food groups, Melnik et al. found similar results in which, on average, 2nd and 5th graders reported servings lower than the recommended amounts for bread, vegetables, and fruit (21). Seventy-two to seventy-five percent of students did not meet 5-a-day recommendations. However, students met recommendations for milk and meat servings. Consumption was affected by school lunch participation, skipping meals, and preparation responsibility (21). These issues were not addressed in Step Up MyPyramid, although their contribution could lead to further explanation of our findings.

The objectives of this study were important to understanding changes seen in the classrooms. Third through fifth grade students receiving in class instruction met only one of the objectives following intervention—increased knowledge of MyPyramid. No improvements in food consumption, physical activity, or attitudes were achieved from the 6-lesson intervention, nor were improved. The majority of students reported positive attitudes about nutrition and physical activity at baseline and remained unchanged at post. The increase in MyPyramid knowledge shows promise for effective intervention with elementary students. More testing or fine-tuning of MyPyramid materials may be needed for working with high risk or limited resource children.

Limitations

Several limitations existed in this study. These included lack of parental consent, low Latino percentages, classroom differences, and the tool used to assess differences between pre and post-assessments.

The low return rate of parental consents contributed to a small sample size and limited findings. In the future, permission might be obtained to mail parental consent forms to the home. This might help in the return rate, although cost would be increased. In addition, there was not an accurate and definite way to obtain the percentage of Latino students in each classroom. A parent demographic survey could be sent home to the parent also in order to obtain this information. Permission to obtain the information from teachers may also be an option.

An uncontrollable limitation included classroom management and student behavior. Classroom differences and age differences could have contributed to findings or uneven characteristics. One example of this was seen in high percentages of correct responses of control participants at baseline. There are many possible reasons for this: students of all grades lacked complete understanding of pre and post-test questions overall, varying levels of language comprehension, and an inability to read or comprehend questions on the pre and post tests among intervention students. Low reading levels and short attention spans made the test difficult for many students. This was increased when classrooms had a large number of students. Large classes also had a more chaotic atmosphere. Schools varied as to whether the teacher stayed in the room in order to help with student participation and behavior.

Initial entrance into the classrooms was overwhelming. Despite much planning, resources were limited in dealing with children of varying reading levels and disruptive behavior. Materials of a lower grade level may have been more appropriate. Additionally, a greater involvement of the teacher would be a valuable asset. Prior to the lessons, learning of each classroom's behavior management plan would aid in keeping the class stable and attentive.

Despite pre-testing the study tools, the pre/post-test used as the evaluation tool had many limitations. Knowledge questions were primarily multiple choice, therefore providing a straight forward and simple format. Behavior questions were presented in a different format. Lengthy wording and self-estimation were limitations of these questions. Food choices from yesterday were to be listed in a table by the student. Many students struggled with grasping the format and goal of the chart. Assistants walked around the room and helped students understand how to fill out the chart, but this might not have reached everyone. Low response rates on yesterday's food and activity choices chart limited results and findings. Additionally, serving size was not defined nor reported. Because of the lack of data, one objective of the study, that of increasing consumption of low fat dairy and whole grains, could not be assessed.

Lastly, sheer lack of interest by all students led to incomplete data. Control classrooms also became frustrated and tired of taking the same post-test multiple times. Problems with the tool, possible cross-contamination, limited parental consents, and classroom differences, all limited results and provide insight into areas of improvement for future research.

Implications

Teaching about MyPyramid in low-income Guilford County Schools with high Latino populations was effective in increasing nutrition knowledge; however, this difference in knowledge between groups was not significant. Attitudes towards health and physical activity did not change. Following the 6 lessons, food choices (behaviors) indicated a decrease in servings of food from all food groups and physical activity. The increase in nutrition knowledge shows promise for interventions with low-income, Latino populations. However, the completion of the intervention did not meet our objectives. These results suggest more testing of MyPyramid materials is warranted in populations of high risk children or those with limited resources.

Step Up MyPyramid did not result in any significant differences between receiving in class instruction versus written materials only. The materials for MyPyramid are available via the web unless teachers request teaching packets. Therefore, computer access must be considered. The

Health Information National Trends Survey found that 64% of Caucasians, 45% African Americans, and 44% Hispanics owned at least one computer in the household in 2003. This same trend is true of low-income households (33). Access to the information is key to having an effect on children's knowledge and behaviors. Materials in Spanish and English can also aid in comprehension, while teaching the language at the same time.

One of the largest challenges was gaining access to the classroom. Schools are an ideal place to target children and provide nutrition and health information. One of these ways is to implement health instruction within the curriculum where it is lacking. Therefore, future nutrition education programs should be designed to incorporate teachers more. As classroom leaders, support and close involvement in teaching could produce more effective results.

Another challenge included difficulty in receiving consent forms back from parents. Differences in ethnicity of children in the school system may help to explain nutrition education's effect. In a study by Birch and Ferrin (2001) comparing Anglo-American parents to Mexican-American parents, worldviews were found to differ between the two. Views are based upon many aspects such as values, culture, gender roles, language, family traditions, socioeconomic status, education and experience. Differences in view can play a large role in Mexican-American students in the classroom in both studies. Even though both groups valued public schooling, Anglo-American parents reported they could participate in and improve education programs. Mexican-American parents felt they could only offer encouragement, rather than involvement in the child's schooling (34). Cultural differences could affect the communication of the school with the parent, including weekly children's folders. The purpose or importance of parental consent forms may not have been understood by all parents. For all children, when a parental consent form is sent home, does it get home to begin with? What is the chance that it will come back? Incentives were used in our study; however, these should be rethought and better planned to benefit not only students, but teachers also.

Lastly, language and comprehension limitations, along with parental consent and involvement, need to be addressed in future research. Spanish materials and materials written at a lower grade level may be more appropriate as English language proficiency varies so widely. Needs of low income households also need to be considered when developing and implementing nutrition education interventions.

A study conducted by the USDA surveyed 5,589 individuals over the phone or face to face interviews as a part of the Continuing Survey of Food Intakes by Individuals. Findings indicated that low income household members, compared to higher income, were not aware of or did not believe in diet-disease relationships. They also had low knowledge of recommended servings from the food pyramid, and were not likely to buy low fat or low cholesterol foods. The highest food priorities reported among low-income group were price, ease of preparation, and foods that keep well (32). These concerns and high priority issues must be addressed in nutrition education. Further research may incorporate topics such as healthy eating on a budget, along with easy and healthy food preparation. More emphasis on the importance of nutrition and its relation to disease and complications may help increase healthy behavior and attitude changes. Incorporating the family as a more all-inclusive approach could also prove to be more effective. There is a need to emphasize that healthy eating is necessary both at school and in the home.

Considering the limitations and challenges encountered, there is needed improvement of methods and materials for nutrition education in order to reach low-income and ethnically diverse children in schools. Although some improvement was seen in nutrition knowledge in this study there were no significant differences found between in class instruction and written materials only. Findings indicated that nutrition education is needed; however, current MyPyramid materials may need to be further tested with high risk children or those with limited resources.

Epilogue

At the start of graduate school, I was unsure of my direction. However, Dr. Haldeman had already received a grant and asked if I was interested in working with low-income Latino child populations. I had an interest in working with children, making the grant a good opportunity for nutrition education. With the rising problem of obesity, particularly growing in a young population, this area of research is important and essential to healthier futures. I had never worked in public schools, so this was a new challenge to overcome.

The first step in the research was to come up with 6 lessons, incorporating MyPyramid website materials along with new materials. The lessons books, worksheets, and posters available on the USDA website were very helpful and provided a large portion of all the materials needed. Computer games or lessons that required equipment were not feasible for the classroom instruction. In addition to organizing materials into lessons, I created some activities and games that would help in the classroom. This step of the process was much easier than I had anticipated. Materials were easily accessible to order from the website.

Following method and material development, permission had to be granted through the county first before contacting individual schools. It was difficult to contact Guilford County Schools and to reach the correct administrators. The process was started in the fall of 2006 and was continuous through the Spring of 2008. School contact was frustrating. Numerous schools did not respond at all following packets and emails. It was also difficult to reach a principal by phone. This was the longest step in the process. Setting up dates for classroom intervention was a struggle for many teachers. Multiple schools agreed to participate, then backed out at the last minute. This required more recruitment and contacting schools again in various grades, rather than just 4^{th} grade. This was the most difficult part of the research—trying to get schools to agree to participate. Continuously having to stay on top of it and resending and contacting principals and teachers was very time consuming. I learned that perseverance is a large part of recruitment.

Once in the classroom, there were new challenges. Since approval was not granted until towards the end of the school year in 2007, this gave me an opportunity to do a preliminary study. This was very helpful in learning what worked and what did not. Materials and lessons changed, along with adding incentives for students to return parental consent forms. Classroom behavior problems and lack of attentiveness influenced lessons significantly. I found that classrooms were more well-behaved when the teacher remained in the room. I learned both in preliminary and intervention classrooms that classrooms had different rates and comprehension which must be paced accordingly. I learned to give some classes more direction, firmer rules, and incentives. In one school, the teachers did not know I was coming to teach as the principal did not relay the information. The lack of communication in some schools was surprising. They were very receptive though once we rescheduled.

Interacting with the children was both challenging and enjoyable at times. There was a wide range of students with varying concepts about health and nutrition. One student was insistent that ice cream is very good for you since it is a dairy and calcium provider. There were many examples like this, making the need for nutrition education very evident. One student gave the example that his brother had just developed diabetes and cited this as the reason why children should have healthy eating habits. After the lesson incorporating whole grains, one student came back to report she had looked on the back of the bread package at the grocery store and found the MyPyramid logo and the ingredient whole grain in the ingredient list. The comments in the classroom from responsive students were encouraging along the process. From observation in the classroom, the students' enthusiasm and age presents a great opportunity to teach about healthy behaviors and attitudes, giving them the resources needed at a young age.

Interacting with the school system was frustrating and not my likely career path in the future. However, I did enjoy the interaction with children and foresee this as a possible target for my career plans.

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APPENDIX A

LESSON PLANS AND MATERIALS

Step Up MyPyramid Lessons for Intervention Classrooms

Day 1
Materials: pretest, poster, crayons/colored pencils, coloring page
Pre-test (20-30 minutes)
As students finish pre-test, hand out fruit & veggie coloring sheet until all students are finished.

Introduction—MyPyramid Poster (30 minutes)
Pass out blank pyramids and crayons and have each student fill out their MyPyramid as you go along.
Go color by color, getting students to tell you what food group each color stands for.
Give or ask for examples of foods in the food group. Eat your colors.
Make half your grains whole.
Vary your veggies.
Focus on fruits.
Get your calcium-rich foods.
Go lean with protein. (define lean)
Physical Activity. (explain what physical & activity mean)
Point out that MyPyramid gives amounts in ounces and cups.
-explain width of stripes
-vitamins & minerals
-foods high in fat & sugar are in narrow region, make occasional

Day 2
Materials: crossword, pictures, blank paper?
Class Discussion (15-20 minutes)
What is nutrition & health? How is food involved? (DINE)
Nutrition = science that studies the relationship between diet and health
What is diet?
Health = health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (WHO)
3imp. Ways to stay healthy this year:
-many different kinds of healthy food, VARIETY
-move our bodies & be active every day
-keep germs away from our hands & our foods to keep them safe (WASH)

Picture Game (20 minutes)
Split the class into 2 teams for a relay. Pictures of a mixture of healthy and unhealthy foods and activities are placed upside down at the front of the relay line. Children come one by one, pick up a picture, decide if it is unhealthy or healthy, and place picture on the appropriate face (unhealthy vs. healthy) at the front of the room. After the relay is over, go through the pictures with the class and ask why each food or activity is healthy or unhealthy.

Vocabulary & Crossword (20 minutes)
-Fist, review what words mean such as vitamins, protein, low fat dairy, antioxidants
Pass out the crossword & have the students try it for a few minutes on their own. Then ask who has found any answers and the whole class can complete the crossword together as you do it on the board.

If extra time remains, pass out blank half sheets of paper to each child. On the board, write an example for your name acrostic. For example, write SARAH down the side of a board and beside each letter, list a healthy food or activity starting with those letters.
Have each child do this for their names. (This can be used at another time if have extra time elsewhere.)

Day 3
Materials: Tips for Families MyPyramid handout, level 2/3book, 5-a-day wksht, Steps to a Healthier You, Posters, Crayons/Markers
Pass out handout explaining MyPyramid with tips for families. Ask the children if they recognize the pyramid and anything they remember from the last classes. Flip to the tips side and have each child read out a tip at a time. Explain or give an example of the tip if necessary. Once completed, have them put it away in order to take the sheet home to their parents. (15 minutes)

Worksheets (20-25 minutes)
Lesson 3 in level 2 book:
Vary your veggies & Focus on fruits
-Have students complete Steps to a Healthier You worksheet
-Discuss answers with the class
5 a day worksheet—the challenge oath

Posters—lesson 3, level 2 book (20-25 minutes)
Split class into groups of 3-4 children and pass out crayons or markers.
Objective: for students to create an advertisement, song, picture, or other creative idea for the promotion of a fruit or vegetable.
For example, a group makes a commercial about broccoli and draws the commercial on the poster board with words or a song to go with it.

Day 4
Materials: Where's the Fat wksht, Food Labels, What's the Score wksht
Presentations (15-20 minutes)
Have each student group present their poster to the class.

Lesson 3 in level 3 book: Reading & Understanding food labels (40-45 minutes)
Discussion with the class:
What is a food label & where are they found?
What is a serving size & where is that listed on food labels?
Complete Where's the Fat? Worksheet with food labels worksheet
Have students try the worksheet individually, then complete with the whole class.
Complete What's the Score worksheet.
Tell students that they can ask for nutrition facts from restaurants or they can read the labels.
Discuss how to make healthy decisions when eating out or at school.
Why are healthy choices important? What if you don't make them?

Discuss this in addition to physical activity. Some of this will be review from the Tips for Families and MyPyramid information. Discuss ways to be active. Have students give ideas and explain the benefits of physical activity. Recommended 30-60 minutes/day.

Day 5
Materials: Portion examples, Food models, Food Math wksht
Discussion (10-15 minutes)
Serving recommendations for each food group per day & serving sizes (review)
Serving size examples (cube, deck of cards, cd case)
Pass these around to the class
Examples of portion sizes
-1pc of bread = 1 oz
-1c measuring cup (cereal = 1oz)
-deck of cards = 3oz meat
-1sm. Apple = 1c

Food models (20-30 minutes)
Bring examples of numerous foods, including culturally relevant foods, in order to pass around the class and to learn to estimate the portion or serving size.
Have students in singles or pairs pick out lunch trays using the food models. The goal is to choose well-balanced and healthy food choices.

Food Math worksheet (20-25 minutes)
Explain that the example of the boy on the worksheet needs to eat breakfast, lunch, dinner, and maybe a snack. What can he eat to meet all the recommended servings. Have the students try on their own. Then, you can have students come to the front and help do an example on the board. Make sure the day includes 6oz grains, 2.5c veggies, 1.5c fruits, 3c milk, 5oz meat/beans, and limited oil group

Day 6 (Materials: poster?, post-test)
Review MyPyramid with the class. (5-10 minutes)
-food groups, servings, questions
Play game. (20-25 minutes)
Split the classroom into 5 teams. Each team will be a food group. Each team member chooses a food in the food group (secretly). Team by team, they will describe the food and its nutritional value without saying what it is. Other teams will try to guess the food. A hand must be raised and called upon by the teacher in order to receive a point.

Post-test (30 minutes)
Students complete the post-test

PRE/POST-TEST

Child's full name _____ Study ID_____
Age _____

Nutrition Quiz
1. How important is eating healthy to you?

Very important kind of important not important at all

2. How important is physical activity to you?

Very important kind of important not important at all

3. A correct **serving** refers to ____
   a. how much a person normally eats
   b. how much a person should eat to follow the guide to my pyramid
   c. how much it takes to feel full

3. Which would be the healthiest drink choice?
   a. 100% juice
   b. soda
   c. fruit punch

3. Circle TRUE or FALSE for the statement.

Fried foods are better for you than grilled foods.

4. Should you eat more from the food groups with the wide stripes or the skinny stripes as shown on my pyramid?

5. How many cups of dairy should you have in one day?
   a. 2
   b. 3
   c. 5
   d. 1

6. The size of a one cup serving is equal to:
   a. a pencil
   b. a basketball
   c. a baseball

7. How many cups of fruits and vegetables do you need every day?
   a. 2 ½ cups vegetables, 1 ½ cups fruits
   b. 4 cups vegetables, 3 cups fruits
   c. 2 cups vegetables, ½ cup fruit

8. How many minutes of being active per day are recommended by MyPyramid?
    a. 15 minutes
    b. 30-60minutes
    c. 120 minutes
    d. 90 minutes

9. Vitamins in fruits and vegetables are important, because _____
    a. they protect us from disease
    b. we need them to heal injuries or cuts
    c. both of the above

10. Milk has _____
    a. Vitamin A
    b. Protein
    c. Calcium
    d. All of the above

11. When choosing foods from the grains & breads category, what word should you look for?
    _____

Physical Activity
Choose the description that best fits your activity level.
12. How many times in the past 14 days have you done at least 20 minutes of exercise hard enough to make you breathe heavily and make your heart beat fast? (Hard exercise includes, for example, playing basketball, jogging, or fast bicycling; include time in physical education class.)
    a. None
    b. 1 to 2 days
    c. 3 to 5 days
    d. 6 to 8 days
    e. 9 or more days

13. How many times in the past 14 days have you done at least 20 minutes of light exercise that was not hard enough to make you breathe heavily and make your heart beat fast? (Light exercise includes walking or slow bicycling; include time in physical education class.)
    a. None
    b. 1 to 2 days
    c. 3 to 5 days
    d. 6 to 8 days
    e. 9 or more days

14. During the past 6 months, how many team or individual sports or activities did you participate in on a competitive level, such as sports, intramurals, or out-of-school programs?
    a. None
    b. 1 activity
    c. 2 activities
    d. 3 activities
    e. 4 or more activities

What activities did you participate in over the past 6 months?

1._____ 4._____
2. _____ 5._____
3. _____ 6._____

Milk	Grains	Oils
Meat & Beans	Fruits	Vegetables

Pick a choice from the word bank above for questions 15-20.

15. What food group does the ORANGE stripe stand for on MyPyramid?

16. What food group does the GREEN stripe stand for on MyPyramid?

17. What food group does the RED stripe stand for on MyPyramid?

18. What food group does the YELLOW stripe stand for on MyPyramid?

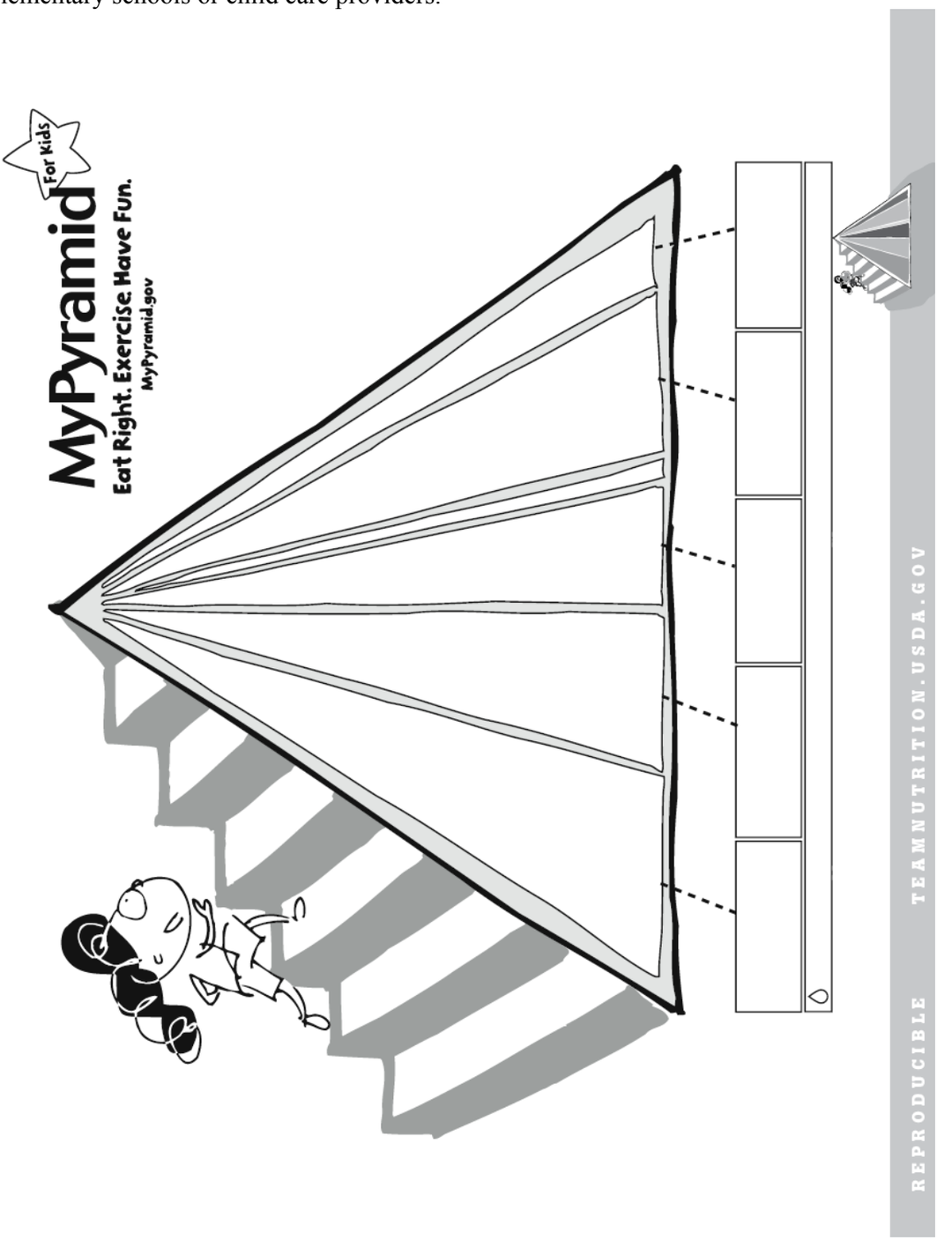
19. What food group does the BLUE stripe stand for on MyPyramid?

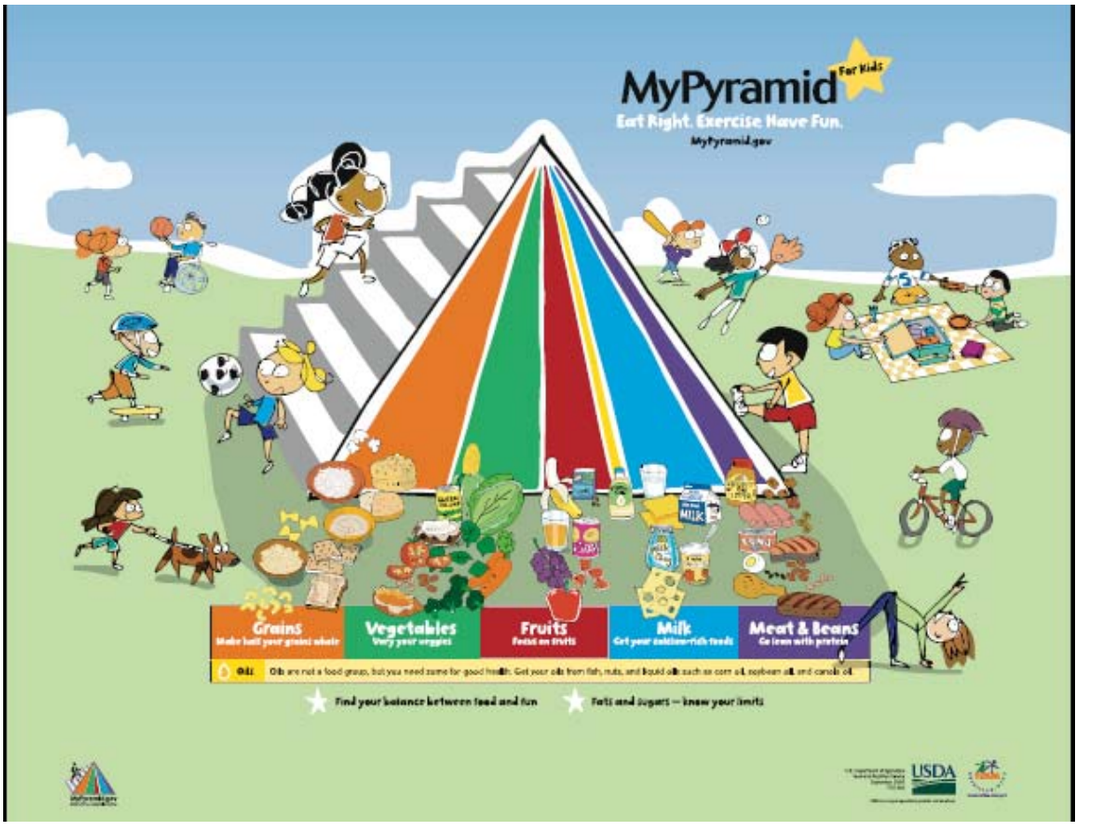
20. What food group does the PURPLE stripe stand for on MyPyramid?

21. Please fill in the chart below what foods you ate YESTERDAY.

	Check in the box below if you ate the food listed to the left.	What did you eat?
Grains		
Vegetables		
Fruits		
Milk		
Meat/beans		
Oils/Fats		
Physical Activity	Did you do any?	What type?

All of the following worksheets in Appendix A are provided by the United States Department of Agriculture. Materials were obtained from their MyPyramid website at http://www.mypyramid.gov/kids/index.html and are publicly available and obtainable per request of elementary schools or child care providers.




MyPyramid
For Kids
Eat Right. Exercise. Have Fun.
MyPyramid.gov
Grains
Vegetables
Fruits
Milk
Meat & Beans
OILS
Oils are not a food group, but you need some for good health. Get your oils from fish, nuts, and liquid oils such as corn oil, soybean oil, and canola oil.
Find your balance between food and fun
Fats and sugars — know your limits
USDA

Name: _____

MyPyramid FOR KIDS

Steps to a Healthier You

My Fruit and Vegetable Goals

Fruits

Circle the names of the fruits you have eaten:

mango papaya kiwifruit cantaloupe

star fruit pineapple strawberry blueberry

Other fruits I have eaten:

_____

_____

_____

Write the name of a fruit you would like to try:

_____

_____

_____

How will you eat this fruit? *(Perhaps on cereal, as a snack, for dessert, with dinner, or on pancakes.)*

_____

_____

_____

Vegetables

Circle the names of the vegetables you have eaten:

spinach collard greens sweet potato

broccoli jicama zucchini squash

Other vegetables I have eaten:

_____

_____

_____

Write the name of a vegetable you would like to try:

_____

_____

_____

How will you eat this vegetable? *(Perhaps for a snack, as a salad, with dip, or for lunch.)*

_____

_____

_____

Where and How

I will try these foods by: asking my parents to purchase them, helping my parents prepare these foods, choosing them from a restaurant menu, eating them from the school lunch menu, or eating them at a friend's house.

_____ _____

Signature Date

Name:

MyPyramid FOR KIDS

What's on the Label?

Milk fat-free

Nutrition Facts
Serving Size 8 fl oz (245g)
Servings Per Container 8

Amount Per Serving	
Calories 90	Calories from Fat 0
	%Daily Value*
Total Fat 0g	**0 %**
Saturated Fat 0g	**0 %**
Trans Fat 0g	**0 %**
Cholesterol < 5mg	**0 %**
Sodium 130mg	**5 %**
Total Carbohydrate 12g	**4 %**
Dietary Fiber 0g	**0 %**
Sugars 12g	
Protein 8g	
Vitamin A 10% · Vitamin C 4%	
Calcium 30% · Iron 0%	

* Percent Daily Values are based on a 2,000 calorie diet.

Milk 1%, chocolate

Nutrition Facts
Serving Size 8 fl oz (245g)
Servings Per Container 8

Amount Per Serving	
Calories 170	Calories from Fat 20
	%Daily Value*
Total Fat 2.5g	**4 %**
Saturated Fat 1.5g	**8 %**
Trans Fat 0g	**0 %**
Cholesterol 5mg	**2 %**
Sodium 190mg	**8 %**
Total Carbohydrate 29g	**10 %**
Dietary Fiber 1g	**5 %**
Sugars 27g	
Protein 8g	
Vitamin A 10% · Vitamin C 6%	
Calcium 30% · Iron 4%	

* Percent Daily Values are based on a 2,000 calorie diet.

Milk 2%

Nutrition Facts
Serving Size 8 fl oz (245g)
Servings Per Container 8

Amount Per Serving	
Calories 130	Calories from Fat 45
	%Daily Value*
Total Fat 5g	**8 %**
Saturated Fat 3g	**15 %**
Trans Fat 0g	**0 %**
Cholesterol 20mg	**7 %**
Sodium 125mg	**5 %**
Total Carbohydrate 13g	**4 %**
Dietary Fiber 0g	**0 %**
Sugars 12g	
Protein 8g	
Vitamin A 10% · Vitamin C 4%	
Calcium 30% · Iron 0%	

* Percent Daily Values are based on a 2,000 calorie diet.

Milk whole

Nutrition Facts
Serving Size 8 fl oz (245g)
Servings Per Container 8

Amount Per Serving	
Calories 150	Calories from Fat 70
	%Daily Value*
Total Fat 8g	**12 %**
Saturated Fat 5g	**25 %**
Trans Fat 0g	**0 %**
Cholesterol 35mg	**11 %**
Sodium 125mg	**5 %**
Total Carbohydrate 12g	**4 %**
Dietary Fiber 0g	**0 %**
Sugars 12g	
Protein 8g	
Vitamin A 6% · Vitamin C 4%	
Calcium 30% · Iron 0%	

* Percent Daily Values are based on a 2,000 calorie diet.

Vanilla ice cream

Nutrition Facts
Serving Size 1/2 cup (65g)
Servings Per Container 14

Amount Per Serving	
Calories 140	Calories from Fat 70
	%Daily Value*
Total Fat 7g	**11 %**
Saturated Fat 4.5g	**23 %**
Trans Fat 0g	**0 %**
Cholesterol 20mg	**6 %**
Sodium 40mg	**2 %**
Total Carbohydrate 15g	**5 %**
Dietary Fiber 0g	**0 %**
Sugars 15g	
Protein 3g	
Vitamin A 4% · Vitamin C 0%	
Calcium 10% · Iron 0%	

* Percent Daily Values are based on a 2,000 calorie diet.

American cheese

Nutrition Facts
Serving Size 1 slice (19g)
Servings Per Container 24

Amount Per Serving	
Calories 60	Calories from Fat 40
	%Daily Value*
Total Fat 4.5g	**7 %**
Saturated Fat 2.5g	**13 %**
Trans Fat 0g	**0 %**
Cholesterol 15mg	**5 %**
Sodium 250mg	**10 %**
Total Carbohydrate 1g	**0 %**
Dietary Fiber 0g	**0 %**
Sugars 1g	
Protein 3g	
Vitamin A 4% · Vitamin C 0%	
Calcium 20% · Iron 0%	

* Percent Daily Values are based on a 2,000 calorie diet.

Fruit-flavored yogurt

Nutrition Facts
Serving Size 6 ounces (170g)
Servings Per Container 1

Amount Per Serving	
Calories 170	Calories from Fat 15
	%Daily Value*
Total Fat 1.5g	**2 %**
Saturated Fat 1g	**5 %**
Trans Fat 0g	**0 %**
Cholesterol 10mg	**3 %**
Sodium 125mg	**5 %**
Total Carbohydrate 33g	**11 %**
Dietary Fiber 0g	**0 %**
Sugars 30g	
Protein 6g	
Vitamin A 0% · Vitamin C 0%	
Calcium 20% · Iron 0%	

* Percent Daily Values are based on a 2,000 calorie diet.

Cottage cheese

Nutrition Facts
Serving Size 1/2 cup (119g)
Servings Per Container 4

Amount Per Serving	
Calories 90	Calories from Fat 20
	%Daily Value*
Total Fat 2.5g	**4 %**
Saturated Fat 1.5g	**8 %**
Trans Fat 0g	**0 %**
Cholesterol 15mg	**5 %**
Sodium 410mg	**17 %**
Total Carbohydrate 6g	**2 %**
Dietary Fiber 0g	**0 %**
Sugars 5g	
Protein 11g	
Vitamin A 4% · Vitamin C 0%	
Calcium 8% · Iron 0%	

* Percent Daily Values are based on a 2,000 calorie diet.

What's the Score?

Here is a way to compare foods to see which foods are the best choices for you. Answer the questions below for these four foods, using *What's on the Label?*

	Fat-Free Milk	1% chocolate Milk	2% Milk	Whole Milk
1. What is the serving size for this item?				
2. Is the serving size realistic? *(Is this how much you would normally eat/drink?)*				
3. How many total calories in one serving?				
4. How many total grams of fat in one serving?				
5. What percent of calcium in one serving?				

Based on this information, which type of milk offers the most calcium with the lowest fat?

Now look at *all* the labels on the page. Answer these questions:

1. If Manuel drinks 8 fluid ounces of 1% chocolate milk and eats 6 ounces of fruit-flavored yogurt, how much calcium has he had? _____

How many grams of fat?

_____

2. Which food item on the sheet has the least calcium with the highest amount of fat?

_____

3. Which food item on the sheet has the most calcium with the lowest amount of fat?

_____

Name: _____

MyPyramid FOR KIDS

Food Math

Jason is 9 years old. He's physically active sometimes. Each day, he needs to eat:

Grains	Vegetables	Fruit	Milk	Meat and Beans
6 ounces	2½ cups	1½ cups	3 cups	5 ounces

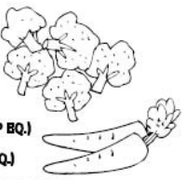
Help Jason decide what to eat today. Plan breakfast, lunch, dinner, and a snack. Be sure he gets all the food he needs from each group. (Food items may be selected more than once.)

Grains 6 ounces

___ 1 slice whole-wheat toast* **(1 OZ EQ.)**
___ 5 whole-wheat crackers* **(1 OZ EQ.)**
___ 1 slice white bread **(1 OZ EQ.)**
___ 1 slice whole-wheat bread* **(1 OZ EQ.)**
___ 1 cup whole-grain ready-to-eat breakfast cereal* **(1 OZ EQ.)**
___ ½ cup cooked brown rice* **(1 OZ EQ.)**
___ 1 cup cooked pasta **(2 OZ EQ.)**
___ 1 hamburger bun **(2 OZ EQ.)**
___ 3 cups lowfat popcorn* **(1 OZ EQ.)**

*Items marked with a * are whole-grain*

Vegetables 2½ cups



___ 6 baby carrots* **(½ CUP EQ.)**
___ 1 large ear of corn **(1 CUP EQ.)**
___ 1 medium baked potato **(1 CUP EQ.)**
___ 1 cup cooked greens* **(1 CUP EQ.)**
___ 1 large baked sweet potato* **(1 CUP EQ.)**
___ 3 spears broccoli* **(1 CUP EQ.)**
___ ½ cup tomato juice **(½ CUP EQ.)**
___ 1 cup chopped lettuce **(½ CUP EQ.)**

*Items marked with a * are dark green or orange vegetables*

Key: (1 OZ EQ.) means (equals 1 ounce equivalent)

Fruits 1½ cups

___ 1 small apple or ½ large apple **(1 CUP EQ.)**
___ 1 large orange **(1 CUP EQ.)**
___ 1 snack-sized container of peaches **(½ CUP EQ.)**
___ 1 large plum **(½ CUP EQ.)**
___ 1 small box raisins **(½ CUP EQ.)**
___ 1 cup 100% orange juice **(1 CUP EQ.)**
___ 1 medium wedge cantaloupe **(½ CUP EQ.)**
___ 1 small wedge watermelon **(1 CUP EQ.)**

Milk 3 cups

___ ½ cup lowfat or fat-free cottage cheese **(¼ CUP EQ.)**
___ 1 cup fat-free milk **(1 CUP EQ.)**
___ 1 snack-sized lowfat or fat-free yogurt **(½ CUP EQ.)**
___ 1 half-pint container 1% or 2% milk **(1 CUP EQ.)**
___ 2 ounces of lowfat or fat-free American cheese **(1 CUP EQ.)**
___ 1½ ounces of lowfat or fat-free cheddar cheese **(1 CUP EQ.)**
___ 1½ cups light ice cream **(1 CUP EQ.)**

Meat and Beans 5 ounces

___ 1 ounce of nuts **(2 OZ EQ.)**
___ 1 cup split pea soup **(2 OZ EQ.)**
___ 1 small chicken breast half **(3 OZ EQ.)**
___ 1 small lean hamburger **(3 OZ EQ.)**
___ 1 hard-boiled egg **(1 OZ EQ.)**
___ 1 tablespoon peanut butter **(1 OZ EQ.)**
___ ¼ cup of pinto beans **(1 OZ EQ.)**
___ 1 slice of turkey **(1 OZ EQ.)**

Where's the Fat?

Popular Fast Foods

Food	***Total Fat (grams)***
Hamburger	*9*
Quarter-pound hamburger	*18*
Fried fish filet sandwich	*18*
Crispy fried chicken	*23*
Chicken nuggets (10 pieces)	*24*
Beef soft taco without cheese	*8*
Beef taco, regular style, without cheese	*7*
Bean burrito, no cheese	*8*
Taco salad with ground beef, no cheese	*39*

1. How many grams of total fat are in a quarter-pound hamburger?

2. How many grams of total fat are in a regular hamburger?

3. Circle the food with less fat:

Taco salad	*OR*	*Beef soft taco*
Bean burrito	*OR*	*Fried fish filet sandwich*
Crispy fried chicken	OR	*Hamburger*

List three ways you can make low-fat choices when you're eating out.

1. _____

2. _____

3. _____

APPENDIX B

VARIABLE DEFINITIONS

Variable Definitions & Abbreviation Names

Variable Definitions	
Question	**Abbreviation Names**
Knowledge **All nutrition knowledge questions were coded as correct (1) or incorrect (2).*	
A correct serving refers to…(b) how much a person should eat to follow the guide to MyPyramid.	A correct serving
Which would be the healthiest drink choice?	Healthiest drink choice
True or False: Fried foods are better for you than grilled foods.	Fried or grilled foods
Should you eat more from the food groups with the wide stripes or the skinny stripes as shown on MyPyramid?	MyPyramid stripes
How many cups of dairy should you have in one day?	Cups of dairy recommended daily
The size of a one cup serving is equal to:…a baseball.	One cup serving
How many cups of fruits and vegetables do you need every day?	Cups of fruits & vegetables
How many minutes of being active per day are recommended by MyPyramid?	Recommended active minutes per day
Vitamins in fruits and vegetables are important because...(c)both—protect us from disease and we need them to heal injuries or cuts.	Vitamins in f/v
Milk has…(d)all of the above—vitamin A, protein, calcium.	Milk nutrients
When choosing foods from the grains & breads category, what word should you look for?	Whole grains
Did they correctly label the grains column/category?	Correctly label grains
Did they correctly label the vegetable column/category?	Correctly label vegetables
Did they correctly label the fruit column/category?	Correctly label fruits
Did they correctly label the oils column/category?	Correctly label oils
Did they correctly label the dairy or milk column/category?	Correctly label dairy
Did they correctly label the meat and beans	Correctly label meat & beans

column/category?	

Attitudes **Attitude variables were coded as:* *(1) very important* *(2) somewhat important* *(3) not important at all*	
How important is eating healthy to you?	Healthy
How important is physical activity to you?	Physical Activity

Behavior **Behavior variables were coded as numbers for various ranges of days.* *(1) none* *(2) 1-2 days or 1 activity* *(3) 3-5 days or 2 activities* *(4) 6-8 days or 3 activities* *(5) 9 or more days or 4 or more activities*	
How many times in the past 14 days have you done at least 20 minutes of exercise hard enough to make you breathe heavily and make your heart beat fast? (Hard exercise includes, for example, playing basketball, jogging, or fast bicycling; include time in physical education class.)	Hard Exercise
How many times in the past 14 days have you done at least 20 minutes of light exercise that was not hard enough to make you breathe heavily and make your heart beat fast? (Light exercise includes walking or slow bicycling; include time in physical education class.)	Light Exercise
During the past 6 months, how many team or individual sports or activities did you participate in on a competitive level, such as sports, intramurals, or out-of-school programs?	Sports or Activities

APPENDIX C

INTERVENTION & CONTROL SUBJECT CHANGE BY VARIABLE

Table 1: Intervention Subjects (N=49) Change from Pre to Post

Variable	Pre & Post Correct N (%)	Pre & Post Incorrect N (%)	Improved N (%)	Decreased N (%)
Correct serving	14 (28.6)	10 (20.4)	15 (30.6)	10 (20.4)
Stripes	26 (53.0)	4 (8.2)	16 (32.7)	3 (6.1)
Cups of Dairy	7 (14.3)	22(44.9)	15 (30.6)	5 (10.2)
One cup Serving	14 (28.6)	22 (44.9)	5 (10.2)	8 (16.3)
Fruits & Veggies	11 (22.4)	12 (24.5)	21 (42.9)	5 (10.2)
Active Minutes	15 (30.6)	14 (28.6)	12 (24.5)	8 (16.3)
Vitamins	7 (14.3)	29 (59.2)	7 (14.3)	6 (12.2)
Milk	7 (14.3)	30 (61.2)	3 (6.1)	9 (18.4)
Orange	8 (16.3)	19 (38.8)	16 (32.7)	6 (12.2)
Green	28 (57.1)	2 (4.1)	10 (20.4)	9 (18.4)
Red	9 (18.4)	11 (22.4)	25 (51.0)	4 (8.2)
Yellow	5 (10.2)	10 (20.4)	29 (59.2)	5 (10.2)
Purple	5 (10.2)	18 (36.7)	19 (38.8)	7 (14.3)
Blue	11 (22.4)	17 (34.7)	13 (26.5)	8 (16.3)

Table 2: Control Subjects (N=39) Change from Pre to Post

Variable	Pre &Post Correct N (%)	Pre & Post Incorrect N (%)	Improved N (%)	Decreased N (%)
Correct serving	21 (53.8)	4 (10.3)	5 (12.8)	9 (23.1)
Stripes	27 (69.2)	7 (17.9)	5 (12.9)	0 (0)
Cups of Dairy	16 (41.0)	11 (28.2)	8 (20.5)	4 (10.3)
One cup Serving	22 (56.4)	10 (25.7)	2 (5.1)	5 (12.8)
Fruits & Veggies	13 (33.3)	8 (20.5)	15 (38.5)	3 (7.7)
Active Minutes	18 (46.1)	6 (15.4)	6 (15.4)	9 (32.1)
Vitamins	13 (33.3)	13 (33.3)	9 (23.1)	4 (10.3)

Milk	12 (30.8)	18 (46.2)	2 (5.1)	7 (17.9)
Orange	8 (20.5)	10 (25.6)	18 (46.2)	3 (7.7)
Green	30 (76.9)	1 (2.6)	5 (12.8)	3 (7.7)
Red	10 (25.6)	6 (15.4)	18 (46.2)	5 (12.8)
Yellow	12 (30.8)	5 (12.8)	17 (43.6)	5 (12.8)
Purple	8 (20.5)	13 (33.3)	14 (35.9)	4 (10.3)
Blue	20 (51.3)	7 (17.9)	8 (20.5)	4 (10.3)

The figure more clearly represents the percentage of students who improved on specific nutrition knowledge questions within either the intervention or control group.

Percentage of Students' Improvement on Individual Knowledge Questions